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MAY 20 1923

Electrical World

Mc-Graw-Hill Company, Inc.

May 19, 1923

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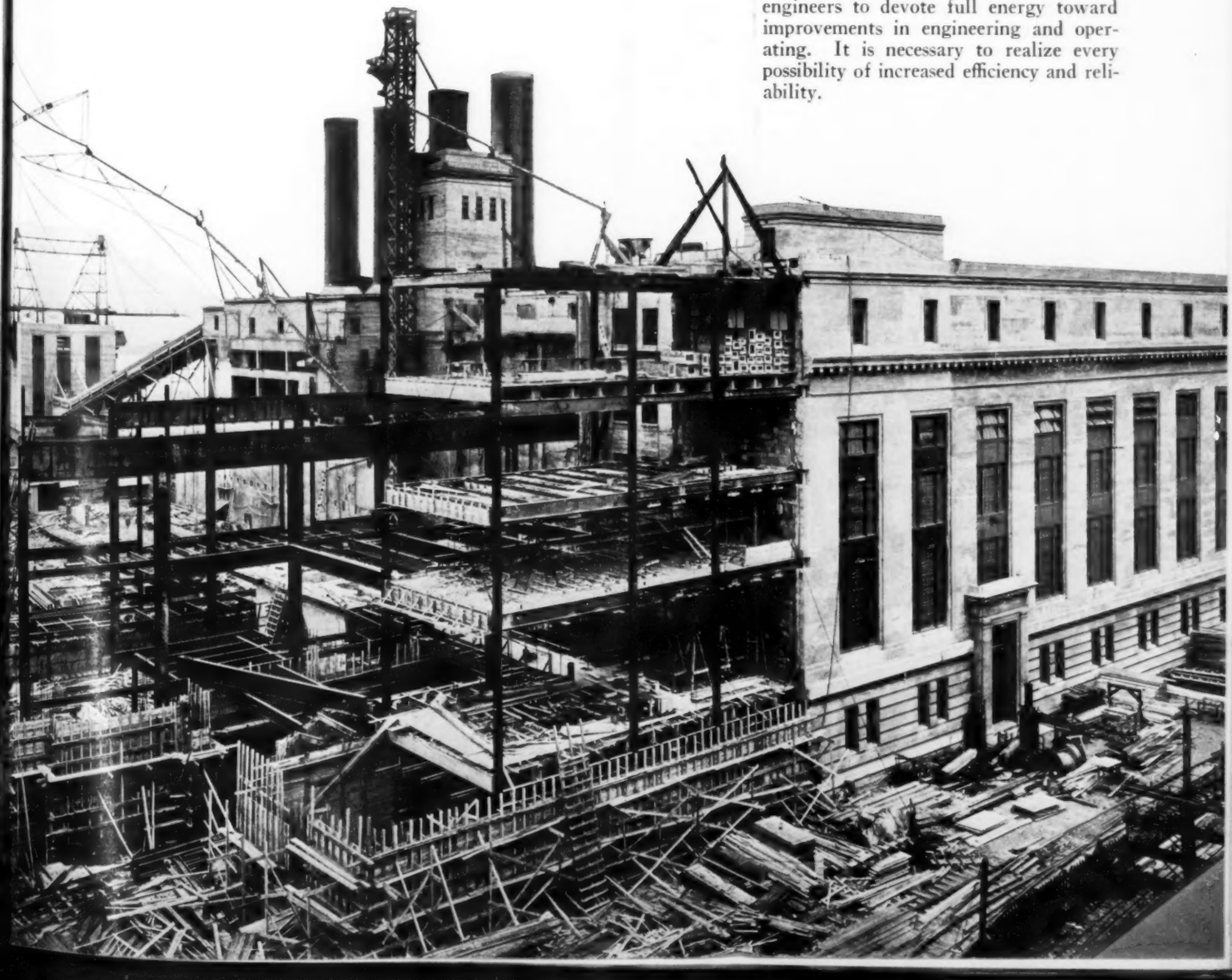
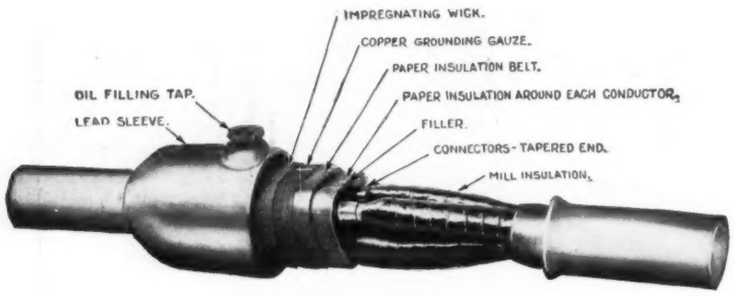
CENTRAL stations are constantly adding to their existing equipment. Growth is so rapid that there is no waiting for new plants to be finished. And even when all available water power is developed the country will still have to rely for electrical supply on the steam-driven station.

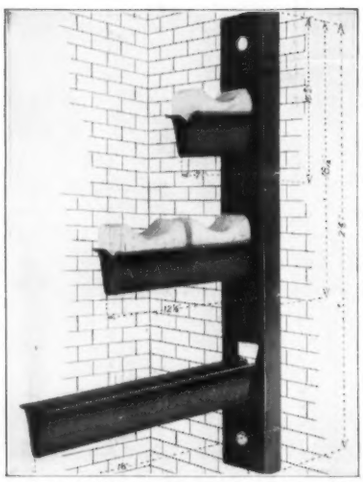
THE remarkable increase in the amount of steam-generated power and in the size and importance of steam-electric plants is causing central station engineers to devote full energy toward improvements in engineering and operating. It is necessary to realize every possibility of increased efficiency and reliability.

Delaware Station of
The Philadelphia Electric Company
Original capacity, 90,000 *kw.*
New extension, 90,000 *kw.*





Detailed View Metropolitan Oil-Filled Cable Joint



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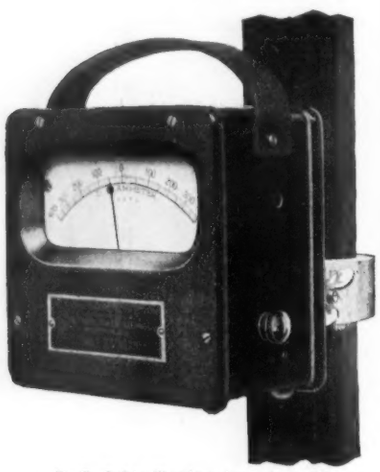
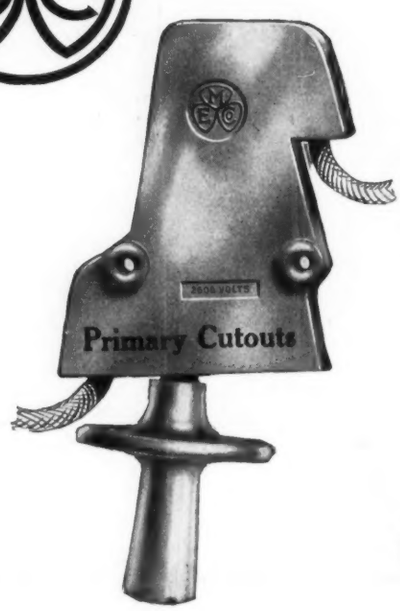
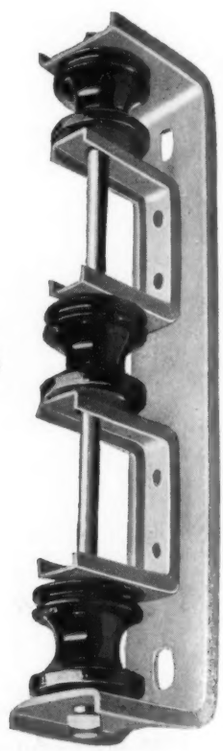


D. C. Cable Testing Ammeter with laminated loop





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Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

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"Excess Varieties"

A WELL-KNOWN manufacturer of electrical supplies recently made the statement that 80 per cent of the articles produced by his firm were carried in its catalog for the purpose of "window dressing." The other 20 per cent, he said, represented practically 85 per cent of the entire volume of his sales. On the theory that this great array of varieties will discourage new competitors from entering the field, four out of every five devices that he makes and sells are forced on the market by the natural influence of their being listed as standard in his catalog.

Since these superfluous varieties are offered, it is no more than natural that central stations, contractors, dealers and industrial plants should order many of them. Jobbers carry them. And the manufacturer himself continues to produce them in small quantity to fill scattered orders that might just as well call for some other device of similar character.

AT THE present time American manufacturers in a wide range of industries are engaged in a broad program of simplification. It is their belief that duplication of product causes waste and that the elimination of dead wood in any line effects economy. Right down the line from the factory to the consumer the production of excess varieties lays a burden of extra cost upon every one who buys or sells or handles them. It means excess patterns, excess dies, excess operations in the making, excess stock for manufacturer, wholesaler and retailer, excess orders, excess bills, excess accounting; and in the case of electrical materials it adds to the cost of installations. It impedes the electrical business. Therefore as a principle and a policy it concerns the entire electrical industry.

It is, of course, quite natural that every manufacturer should desire to discourage newcomers from entering his field and unnecessarily increasing the competition for existing business. Excessive competition between manufacturers and wholesalers who produce and sell duplicate lines of too many varieties in too small quantities undoubtedly is one of the bad features of the present situation. But is there not a better way to go about it?

BY THE simplification of his line and by the mass production of more standardized staples a manufacturer can reduce his cost and his price and protect his business far more effectively than by endeavoring to frighten off new competitors by camouflage in the form of a catalog loaded down with obsolete, duplicate or other excess varieties. There is greater security for the manufacturer in following along economic lines and keeping costs down in the public interest than in any form of repellent "window dressing" that imposes added burdens of expense on the entire industry. Efficiency is the greatest armor in the world.

It is encouraging therefore to observe the amount of attention which this broad problem of simplification is right now receiving from both electrical manufacturers and jobbers. It will be a great service to the electrical business if together they can perfect a program that will relieve the market of the present glut of excess varieties in many of our important commodities.

Lewis Taylor Robinson

A leading exponent of standardization who is noted for his courtesy, common sense and understanding of human relations.

STANDARDIZATION came into existence as a slogan and a fact only after unusually strenuous efforts to co-ordinate the opinions and practices of engineers and manufacturers had been made by a few far-seeing leaders. In this work the outstanding requirements were persistency, perspective, enthusiasm and an understanding of psychology. Lewis T. Robinson proved to have these traits to an unusual degree, and his winning personality, his sound common sense and his broad perspective materially helped the work of standardization over many serious obstacles.

Born in Springfield, Mass., Oct. 20, 1869, he was educated at Reading and Lynn and then started his career in the electrical industry by taking charge of the standardizing laboratory of the Thomson-Houston Electric Company. In 1891 he became a member of the testing firm of Whitmore & Robinson and in 1896 took charge of the standardizing laboratory of the General Electric Company. Later he was promoted to his present position as engineer in charge of the general engineering laboratory. During this period he has contributed to the engineering development of instruments and machines and has exercised executive supervision with unusual success. Democratic, good-humored, witty and forbearing, he has encouraged and inspired his coworkers and "humanized" the engineering activities of the company.

He has found time to contribute valuable services to the industry as a whole and has held high offices in many engineering organizations. He served as a vice-president of the A. I. E. E. in 1916-18 and 1920-21 and is a past-chairman of the standards committee. His services were in demand at the founding of the Federated American Engineering Societies, and he maintains close contact with many committees working for the advancement of the industry. Mr. Robinson is the author of important papers and is active in the N. E. L. A. He is a member of the United States National Committee of the International Electrotechnical Commission and is on the committee on insulation of the National Research Council.

Untiring worker and self-made man, Lewis T. Robinson has a host of friends and a record of achievements that have made for him a secure position both as man and leader in the annals of the electrical industry.

Editorial Comment

Electrical World, May 19, 1923

Volume 81 Number 20

The Forthcoming Electric Light Convention

LIKE a banquet table fully set, the program for the convention of the National Electric Light Association is filled with delectable things. Statesmen, bankers, captains of industry, public service commissioners and others will address the various meetings in addition to representatives from the industry itself. Replete with all manner of reports and papers as these annual gatherings usually are, this year's program seems remarkably so. At no period of the association's history has interest in its affairs been keener or its work more productive, and naturally this condition is reflected in the annual convention. A record-breaking attendance is anticipated, for, aside from the attractions which New York affords, the wealth of material represented in this year's program provides an added incentive for electrical men from all parts of the country to be present. Certainly no phase of the electric light and power business has been overlooked, and all told the convention should go down in history as one of the greatest the industry has ever held.

Is the Real Voice of Your Company Mute?

WHAT is the difference between advertising and publicity? Some central-station men may think that it doesn't matter much, that this is just a technicality. Not so. And the important difference is this, that advertising is a sales function, whereas publicity is in reality an executive function. Broadly, the distinction may be made that advertising is a message from the company to its customers about something that the company wants to sell, while publicity is a message from the company about itself. And the man who speaks thus for the company to the community should be an executive.

In too many utilities the president and the general manager retire into modest seclusion. They make no speeches to their townspeople. They write no personal letters to their customers. They express themselves directly in no printed messages. They forget that they head the most vital industry in the community, that they are the two men whom the public look upon as "the company." They keep their personalities out of the picture, whereas what the situation needs is a personal intimacy with the public. The words of the company they leave entirely to the articulation of the sales manager, whose costs they scrutinize, holding him strictly to account for sales. And so the company's speech is neither free nor frank. It does not express the thinking or the character of the executive, who is seen and met only in chance confidential conversations with individuals in his private office.

By contrast, those company executives who have taken the plunge and have appeared to their public in ways mentioned here have reaped the benefits manyfold and are enthusiastic supporters of such action.

Executives like frank opinion and plain speaking from the men of their own organizations that they may learn their measure and have the "feel" of their judgment and their self-reliance. By the same token does the community desire to hear and see and know these chief men who operate its central station and are therefore in an entirely real sense the employees of the public.

The voice of the chief executive should be recognized and listened to with confidence in the community and not habitually held to speak in secret to those alone who come to him. The rest of the people, for whom he is also working, are quite as interested and are entitled to hear no less.

Putting Confidence in Young Blood

NO ARGUMENT is necessary to prove that unless the electrical industry attracts youthful workers to enter its service and embrace its opportunities from one year's end to another it will become moribund. Progressive executives act upon this fact when they open the doors of their plants and factories, stores and offices to ambitious young employees and so infuse new blood into established concerns. Not a little has been said of late about the importance of pecuniary compensation in keeping younger employees contented in the utility and other fields in which electricity plays a vital part. While the money reward, or at least the outlook in that direction, is undeniably important, yet to less mature workers there are other considerations quite as weighty and not seldom more prevailing than the question of present salary.

The rapid progress of virtually every phase of work in the electrical industry presents an appeal to younger employees which should be capitalized with insight by their superiors. In not a few cases the failure of executives to permit responsibility to remain upon qualified employees' shoulders has led to the loss of valuable and promising human material to other industries. The policy of taking away a particular job from a young man just as he reaches its thoroughly interesting stage is responsible for the departure of some workers into other fields, and the same remark applies to the policy of keeping employees in the dark as to the reasons for company practices, to a failure to give credit to the privates and non-commissioned workers of the industry for significant achievements, and to a lack of interest by executives of lower rank in the prospects and ambitions of their personnel. Even the dropping or irregular publication of an accepted company house organ is a blow to the morale.

Every modern business faces the problems hinted at, but surely in the electrical industry there is little

excuse for treating the ambitious employee as a mere cog in the wheel. Whenever he or she is doing significant work, let that significance be known to the doer. It may be a compilation of costs for presentation in a rate case or a computation of voltage drops in feeders as a part of an economic study of equipment development; it matters not which, but special effort may well be made to avoid submergence in a sea of routine too deep for getting a view of the bearings of the organizational craft as it moves forward into areas of greater service. Wise supervision is one thing in holding the employee's interest, but a policy of keeping him outside a proper knowledge of what is going on is quite another.

Capitalize Maintenance Expense to Ascertain Value of Reliability

ALTHOUGH purchasing agents of some operating companies may be tempted to buy the cheapest equipment available so long as it is not notoriously inadequate, no operating engineer who has a voice in purchases will sacrifice reliability to a saving in first cost. Too many contingencies arise in practice, even when the greatest precautions are taken, to permit him to slight the factor of reliability. None the less, this factor is often looked upon as an intangible consideration, and hence the relative values of transformers are likewise assumed to be indefinite. Whatever truth there may be in this assumption, a very good basis for determining what can be paid for increased reliability can be obtained by keeping records of unit transformer repair and replacement expenses for different classes of equipment used. Capitalized and added to the first cost of the transformers, these expenses will permit the calculation of a more nearly true value of the relative cost of transformers than the initial cost would indicate.

Standardization Rarely Attempted for Transmission Towers

APPARENTLY basic differences in design and operating conditions prohibit any great amount of standardization in line-tower construction. This fact is clearly brought out in the article in this issue by H. L. Sharp, there being a considerable difference in the towers which this one company recently installed on several different lines. One element in the situation which influences variety of design is a desire to determine the relative merits of different designs in view of the lack of field data regarding the use of steel towers over long periods of time.

The transmission structures built in recent years have usually been required to satisfy only some general conditions. It seems to be the practice that double-circuit tangent towers, for example, should stand where two of the six conductors are broken, angle towers should not fail when more than two of the six conductors are broken or a corner load is placed on them, and dead-end or anchor towers should carry the load accompanying the dead-ending of all line wires or unusual corner loads. From the article it is evident that the line described has, for its tangent towers, flexible frames with no longitudinal strength, instead of "intermediate" towers, and that the semi-anchor towers are equivalent in loading to the tangent towers used in the usual line. This installation serves to illustrate the lack of agreement among engineers in regard to the broken-wire condition of loading. Indeed, there is considerable doubt whether the assumption that all wires may be broken, at a crossing for example, is not in conflict with the assumptions on which the tower lines are designed.

Another interesting feature of the design is the use of double-double insulators at railroad crossings. Some designers prefer the type of construction used at the semi-anchor towers, but it may be that either a railroad specification or mechanical necessities caused the installation of the double-double insulators. Moreover, the ground wires are described as made of double-galvanized, high-strength crucible steel cable, and since, presumably, they are of greater strength than the conductors, a question arises as to whether a lower grade of steel would not have been easier to handle in the field. It would also be interesting to get a definition of the term "double-galvanized," as differences of opinion on this subject exist among transmission line engineers.

While it is not always feasible to carry a design from one line for use on another, yet surely the detailed record of design and construction practices used on the Niagara, Lockport & Ontario system should prove very valuable to engineers working on lines in other territories.

Successful Automatic-Plant Operation in New England

NEARLY a year's experience with automatic operation at the Searsburg hydro-electric plant of the New England Power Company lies back of the article by E. B. Collins published elsewhere in this issue, and it is gratifying to record the success of the installation from both the labor-saving and the reliability standpoint. The plant is one of the largest automatic generating stations in the country; it is situated on a stream of unusually interesting characteristics and development, and it forms a part of a system noted for skilled engineering and up-to-date operating methods. Searsburg has been running more than 90 per cent of the time since last summer. No important changes have been required in its electrical equipment and only minor alterations in its mechanical features.

It is interesting to note how some of the problems in design which confronted the company's engineers and those of the manufacturers have been worked out in this station to insure maximum convenience and reliability of operation. These were outlined by Messrs. Conger and Dow of the New England company in a paper presented before the 1921 fall convention of the New England Division of the N. E. L. A., and not a little ability in anticipating requirements was then manifested. Some attendance was necessary at the plant in the past winter on account of its remoteness from populous centers and because of rack clearing and other factors not directly governed by equipment design, but full automatic operation has been generally practiced, with time-clock and float control and loading according to predetermined settings of governing equipment. Instrumental readings have been telephoned to other points, and the cost of providing for their automatic transmission has not yet been thought warranted.

Governor regulation operates within a range of about one-half cycle above and below normal, but since it is desirable that Searsburg shall carry a fairly uniform load while in operation the governor is designed to do

somewhat less than its proportional share of regulating. The speed of gate opening is cushioned by a dash-pot mechanism, and in starting about two and one-half minutes is required to reach full gate opening. The plant is provided with a surge tank capable of taking care of disturbances when full load is dropped instantaneously or when there is an instantaneous load increase of 50 per cent. The dash-pot mechanism is adjustable for a five-minute maximum opening period. The co-ordination of gate operation and brake service appears to have been carefully worked out, and the use of strained water instead of oil in the latter is giving good results. Other features include provision for cutting off water from the scroll case for inspection, repairs or shutdown; arrangement for automatic stopping of the unit in case of overheated bearings or insufficient governor pressure, and means of operating the generator as a motor for power-factor correction if desired, although its remote location with respect to the system load center renders this a rare necessity. No attempt has been made to use automatic flashboards, but as the headworks are provided with a power-driven submerged floodgate, the work required in connection with flashboards is greatly reduced.

By and large, the installation appears to be giving an excellent account of itself and it is safe to say that, young as the art of automatic control is, its usefulness is being demonstrated in practical service with increasing emphasis. A plant of the rating and head illustrated by Searsburg shows that the possibilities of automatic operation will not long be confined to stations of a few thousand kilowatts if the general conditions are favorable to the use of this new but highly developed type of apparatus.

How Good Public Relations Are Not Built

A STORY known as the "bedbug story" is going the rounds among after-dinner speakers which has a good moral for utility public relations men. A man encountered bedbugs in a sleeping car, so the story runs, and wrote a very indignant and scathing letter to the proper official. A kindly, courteous letter of apology, with an explanation that the occurrence was most unusual and that every precaution was taken against it, was received, which made the indignant passenger feel that there were some real people in the world after all. Then he discovered his original letter attached to the reply, and across it was written in blue pencil: "Send this guy the bedbug letter." The complainant's state of feeling can be imagined better than described.

The "bedbug letter" type of public relations work, which has only been hung on the sleeping car as a convenient vehicle, is the reason why some men make a failure of winning the public. Good public relations are built only on sympathetic feeling, an ability to understand the other fellow's problems and an earnest effort to prevent the incidents that build ill will. The "send this guy" attitude strikes a note of insincerity which, when discovered, makes existing ill will twice as bitter. Form letters, set rules for pacifying a complaining public and all such devices are a failure. Personal contact and efforts to correct bad situations mean endless work and sometimes drudgery, as well as the most rigid personal honesty, but they are the important factors in keeping on good terms with the public.

Problems Yet to Be Solved in Carrier-Current Telephony

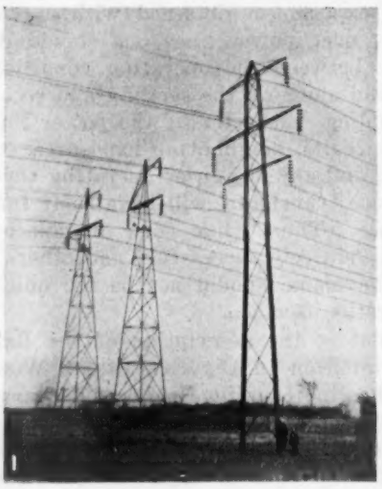
IN COMPARING experiences obtained with carrier-current telephony over power lines one should differentiate carefully between the operating conditions. Results do not depend alone on the sending and receiving sets. Line coupling, character of the power lines, number of branch circuits, neighboring exposures, condition of insulators, and any design or operating condition that will produce transients, will have their influence on performance. Thus, while some installations may be reported as "entirely successful" and others as less satisfactory, the blame should not be too quickly placed on the apparatus used.

It was brought out in the description of the Baltimore-Holtwood installation in the ELECTRICAL WORLD for May 12 that the line coupling had to be changed several times before it was fairly satisfactory and is still not all that could be desired. Then, as pointed out in the discussion of the Duquesne Light Company's experience in the April 21 issue, there is the uncertainty of what determines the limits of the wave bands that are desirable for carrier-current communication. If resonant or impedance conditions are absorbing or choking the carrier current, the possible source of these obstacles must be known and fully understood in order to remove them. Another condition which arises in complicated transmission systems and affects communication is the cutting in or out of branch lines. Each line tap is known to have the effect of adding 15 or 20 miles to the length of transmission, and cables introduce still more complications. Harmonics inherent in the design of a system or disturbances caused by the charging of arresters or by "spitting" insulators, arcing grounds, switching and so forth are also factors which influence to no small degree the quality of carrier-current communication.

Despite all these difficulties, enough carrier-current installations are being made to afford a widespread field laboratory in which all the problems may be worked out if adequate records of performance and analyses are made. In seeking to overcome existing difficulties, however, it will be well to keep in mind the advisability of developing equipment for duplex operation. If this is not done, the user who is accustomed to the ordinary telephone may become confused in an emergency if he has to operate a button to allow two-way conversation. Another great advantage of wired telephones that must not be overlooked in developing the carrier-current telephone is that any patrolman can connect a portable instrument to the telephone line at any point. Some substitute arrangement that can be used with carrier-current telephony without too great expense must be worked out.

With full recognition of most of the difficulties and without any immediate prospects of profit in view, manufacturers are to be congratulated on their broad viewpoint in carrying on the work they are doing. They deserve every bit of support that operating companies can give them in solving the problems which still have to be faced before carrier-current telephony can be relied upon in emergencies. From the work that is now going on it is quite evident that operating companies foresee the possible benefit to themselves which will accrue from establishing a reliable means of communication in emergencies and that this support will be forthcoming without any pleading.

Steel Towers for New Line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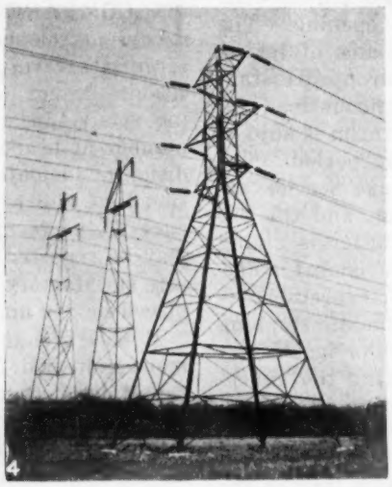
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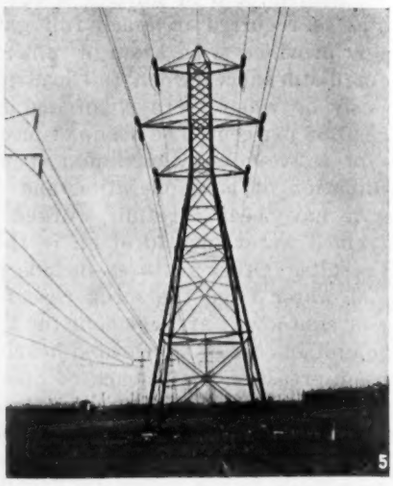
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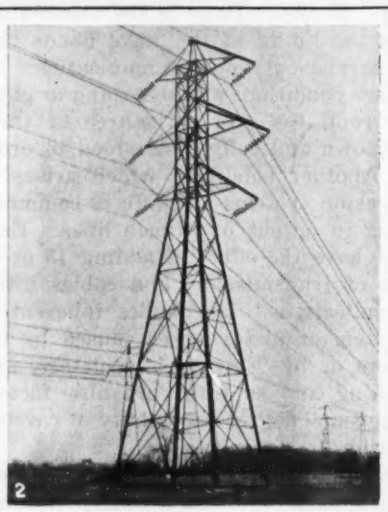
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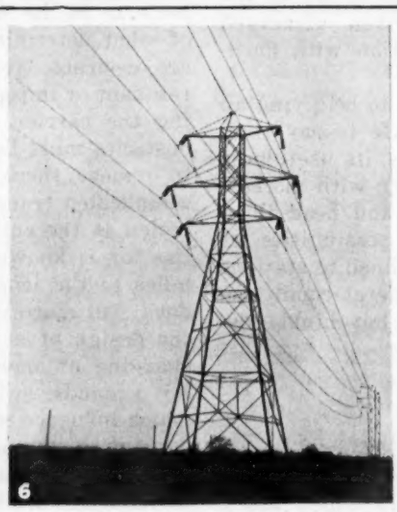
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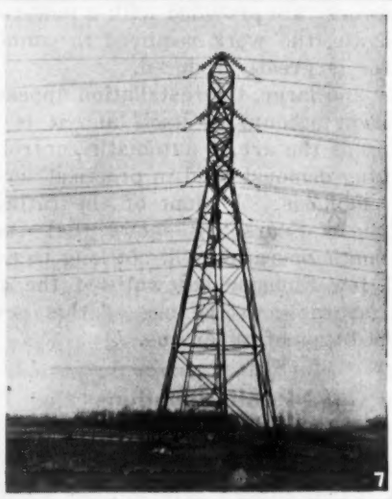
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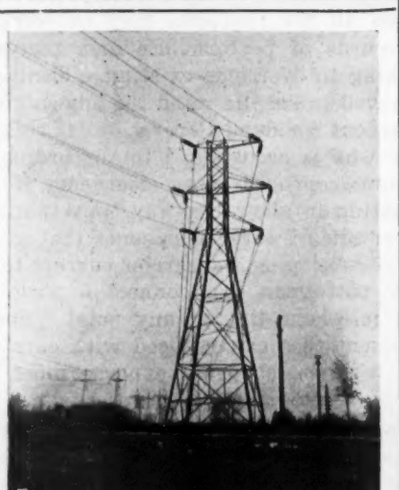
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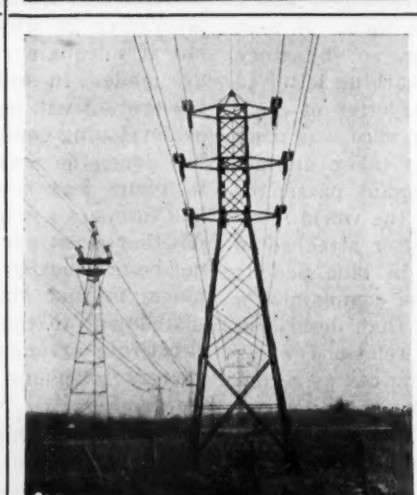
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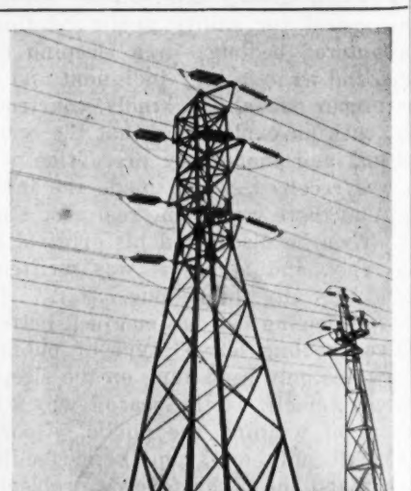
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TYPICAL examples of the steel towers used on a 45-mile, 110,000-volt, double-circuit steel-tower line installed by the Niagara, Lockport & Ontario Power Company. A wind pressure of 13 lb. per sq.ft. on one and one-half times the projected area was assumed and a factor of safety of three was adopted. A double-galvanized extra-strength steel ground wire was used and a double-double insulator construction for crossings. Flexible towers are used for tangent lines and up to a 3-deg. angle. No. 1—Flexible tower type. No. 2—Thirty-degree angle tower. No. 3—Sixty-degree angle tower. Nos. 4 and 5—Dead-end towers. Nos. 6 and 7—Semi-anchor towers. Nos. 8 and 9—Railroad crossing towers.

Double-Circuit Tower Construction

Specifications, Design Details and Costs on New Steel-Tower Construction for 110,000-Volt Line—Foundation Arrangements and Methods for Installing Towers Discussed

By H. L. SHARP
Engineering Department, Niagara, Lockport & Ontario Power Company

STEEL-TOWER transmission lines offer opportunity for a great deal of engineering skill in design and installation. The type of structure is such that design formulas are difficult to use, and the variation in requirements for installation brought about by terrain conditions all add to the economic difficulty of satisfying requirements.

During the last year about 45 miles of new double-circuit steel-tower lines was erected in western New York as a part of the high-voltage system of the Niagara, Lockport & Ontario Power Company. This construction consists of two separate lines, one paralleling existing lines on right-of-way which the power company already owned and the other on an entirely new right-of-way which was recently purchased and on which no other lines existed. These lines were designed and built for 110,000-volt operation, but for the present they are being operated at 60,000 volts.

Tower Types and Loading Specifications

The towers on these lines consist of several types. They were designed to sustain, with a factor of safety of three based on the ultimate strength, the loading given in Table I, together with their own weight and wind pressure of 13 lb. per square foot on one and one-half times the projected area of the steelwork.

The tower tops are provided with three cross-arms, so that the three conductors of one circuit are on one side of the tower and the three conductors of the other circuit on the opposite side of the tower. The top and bottom cross-arms are approximately 18 ft. long and the middle cross-arm is approximately 24 ft. long. Thus the wires on the middle cross-arm are 3 ft. beyond the vertical line through the other wires. The purpose of this arrangement is to reduce the chances for line trouble due to wire contacts with unequal ice loading on the various wires or other conditions which produce unequal sags in the wires.

These cross-arm lengths were determined by the insulation requirements. On all towers the clearance between the nearest live part and the steelwork of the tower, when the insulator string is in its normal position, is not less than 40 in. This refers to the distance between the end of the suspension clamp and the cross-arm or brace below the wire when the insulator string is vertical, or if there is an angle in the line so that the insulator string is deflected from the vertical, then it refers to the side of the tower or any other steelwork. When the suspension insulator string is momentarily deflected by wind to an angle of 45 deg. with the vertical, the clearance between nearest live parts and steelwork is not less than 36 in. The length of the insulator string from the surface which supports the insulator hook to the end of the cable clamp is 53 in.

On dead-end and 60-deg. angle towers the conductor loops between the strain clamps have a normal clearance of 44 in. to steelwork in all directions. This allows a slight swaying motion of the loop without reducing the clearance below the minimum specified value of 36 in. The 60-deg.-angle towers have cross-arms longer on one side of the tower than is the case on straight-line dead-end towers in order to maintain the loop clearances under all conditions.

The tower heights were determined by the condition that the distance from the surface of the ground to the lowest conductor should not be less than 25 ft. with maximum sag in the conductor. Thus the distance from the ground to the lowest cross-arm for level ground is 25 ft. plus maximum sag plus length of suspension insulator string. For strain towers the length of insulator string is not included. In order to maintain the desired clearances over uneven ground suitable extensions are provided for the various types of towers. These are added to the lower portion of the towers. Over highways the minimum clearance of 30 ft. is maintained.

TABLE I—LOADING FOR TOWER DESIGN

	Power Wires			Ground Wire			Each Telephone Wire		
Tower Type	Parallel-Line Load, Lb.	Cross-Line Load, Lb.	Vertical Load, Lb.	Parallel-Line Load, Lb.	Cross-Line Load, Lb	Vertical Load, Lb.	Parallel-Line Load, Lb	Cross-Line Load, Lb.	Vertical Load, Lb.
Flexible	0	700	1,400	0	600	550	0	600	550
Dead-end	*6,500	700	1,400	5 500	600	550	2,000	600	550
Semi-anchor	†6,500	700	1,400	†5,500	600	550	0	600	550
30-deg. angle	0	700	1,400	0	600	550	0	600	550
60-deg. angle	*6,500	700	1,400	5,500	600	550	2,000	600	550

* Tower to sustain unbalanced head pull of 6,500 lb. on all power wires.
† Semi-anchor tower is to sustain the unbalanced head pull due to any two broken wires.

Tower Types and Locations

On the right-of-way where the new line parallels the two existing 60,000-volt lines the new towers were erected opposite the towers on the old lines and at such a distance from the nearer line that the nearest adjacent wires are 15 ft. apart under normal conditions.

On the new right-of-way which was recently purchased in fee, there were no existing transmission lines to influence the location of the new towers. This right-of-way is 50 ft. wide and the towers are erected on a center line which is 20 ft. from one edge and 30 ft. from the other edge.

The location of the towers of the various types was determined as follows:

Flexible Towers.—Flexible towers are installed on straight portions of the line and on deflection angles up to 3 deg. On new right-of-way where no parallel line exists the normal spans are 600 ft. The anchors for

these towers consist of steel members buried in the earth without concrete. In order to provide a secure anchorage before the earth backfill has had time to become thoroughly compacted, this steelwork is installed according to Fig. 1, where the ground is suitable. This method provides a solid wall for the anchor legs to resist wind loads from either side and a considerable volume of undisturbed earth to resist uplift. The planks in the bottom of this footing help materially during the first year or two. The ground is not always such that straight walls can be cut or such that undercutting is possible. In that case the anchor is installed without undercutting the earth, and the earth is backfilled over the footing in the usual manner. In wet ground concrete is placed around the footing as shown in Fig. 2. Where solid rock is encountered the footings are installed according to Fig 3. If the rock is not perfectly solid, but has seams or is of a soft character, it is removed by blasting or otherwise so that a normal earth footing can be installed.

Thirty-Degree-Angle Towers.—These are square-base towers which are used with a single string of suspension insulators for each wire to support deflections in the line of 3 deg to 30 deg. Special cross-arms are used so that sufficient clearance is maintained between live parts and steelwork when the insulator strings are held in an oblique position due to the angle in the line. On angles up to 15 deg. earth footings are used, and on angles from 15 deg. to 30 deg. concrete footings are used.

Sixty-Degree-Angle Towers.—These are square-base towers which are used to support deflections in the line of 30 deg. to 60 deg. They serve the purpose of dead-end towers as well as angle towers. Insulators on these towers are used in the strain position. The cross-arms are unsymmetrical about the center line of the tower in order to maintain the necessary clearance between the conductor loop and the side of the tower. These towers have concrete footings.

Dead-End Towers.—Dead-end towers are erected approximately every two miles. They are suitable for dead-ending all wires under maximum loading conditions. Concrete foundations are used. In order to reduce the amount of concrete in the foundations necessary to sustain the overturning effect of the dead-end cables the bases of these towers were made 30 ft. long

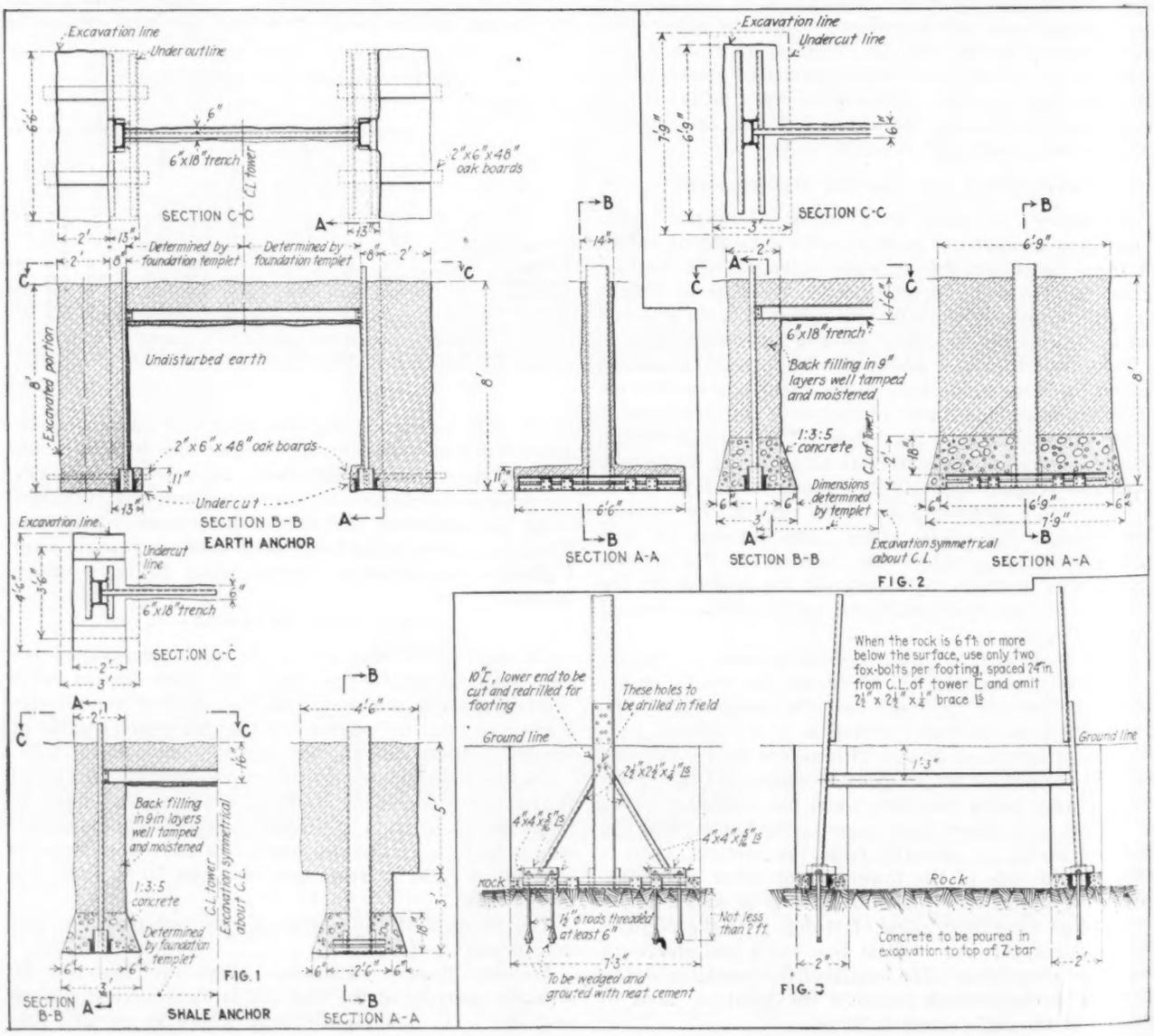

Excavation line
Under outline
6"x18" trench
2"x6"x48" oak boards
SECTION C-C
Determined by foundation templet
Undisturbed earth
Excavated portion
2"x6"x48" oak boards
Undercut
SECTION B-B
EARTH ANCHOR
SECTION A-A
Undercut line
Back filling in 9" layers well tamped and moistened
1:3:5 concrete
Dimensions determined by templet
Excavation symmetrical about C.L.
FIG. 2
Back filling in 9in layers well tamped and moistened
Determined by foundation templet
FIG. 1
SHALE ANCHOR
10"I, lower end to be cut and redrilled for footing
These holes to be drilled in field
Ground line
rock
1½" ø rods threaded at least 6"
Not less than 2 ft.
To be wedged and grouted with neat cement
When the rock is 6 ft. or more below the surface, use only two fox-bolts per footing, spaced 24 in. from C.L. of tower I and omit 2½"x2½"x¼" brace ls
Rock
Concrete to be poured in excavation to top of Z-bar
FIG. 3

FIG. 1—EARTH AND SHALE ANCHOR FOR FLEXIBLE TOWERS. FIG. 2—FOOTINGS FOR FLEXIBLE A FRAMES IN WET GROUND. FIG. 3—ROCK FOOTINGS FOR FLEXIBLE TOWERS

in the direction of the line and 18 ft. wide across the line.

Semi-Anchor Towers.—Semi-anchor towers were installed so that two of them are at approximately equal intervals between dead-end towers; thus if dead-end towers are two miles apart a semi-anchor tower would be located two-thirds of a mile from each dead-end. Semi-anchor towers are designed to sustain the unbalanced load of any two broken wires. In good ground the footings are installed without concrete. If the ground is wet or otherwise unsuitable for earth footings concrete is added to give greater stability.

Railroad Crossing Towers.—Railroad crossing towers were of special design to meet the railroad companies' specifications. These towers are shown in the illustrations on page 1132.

The foundation members for all towers are held in place during installation by means of steel templets so designed as to hold the main members of the foundation in their proper relative positions.

INSULATORS ARE STANDARDIZED

On flexible, semi-anchor and 30-deg.-angle towers the insulator strings consist of seven units. On semi-anchor towers two insulator strings are used to support each conductor, the strings being arranged at 45 deg. to the vertical in the direction of the line. The conductor passes straight through as on a suspension tower and does not have a loop between clamps as on a dead-end tower. Long, flat steel links are used between the semi-anchor cable clamps and the insulators in order to place the conductors the same distance below the cross-arms as on the flexible towers. On dead-end and 60-deg.-angle towers the strain insulator strings consist of nine units. At railroad crossings double strings of nine units assembled in parallel, with steel yokes at each end, are used on the crossing spans.

TABLE II—AVERAGE COSTS PER MILE FOR LABOR AND MATERIAL

A—Length of line, 14.5 miles; conductors, six 400,000-circ.mil copper; ground wire, one ½-in. crucible steel; normal spans, 550 ft.

B—Length of line, 28.8 miles; conductors, six No. 4/0; A.C.S.R.; ground wire, one ½-in. crucible steel; normal spans, 600 ft.

	A—Cost per Mile			*B*—Cost per Mile		
	Labor	Material	Total	Labor	Material	Total
Conductors, ground wire, insulators and hardware	$1,090	$7,400	$8,490	$660	$3,580	$4,240
Towers and foundations..	2,085	2,270	4,355	2,420	2,060	4,480
Total.....	$3,175	$9,670	$12,845	$3,080	$5,640	$8,720

USE GALVANIZED GROUND WIRE

On one of the lines the conductors are 400,000-circ.mil medium-hard-drawn copper. They are strung with such sags that the maximum tension will be 6,000 lb. at 0 deg. F. with ice coating ½ in. thick all around the cable and wind pressure of 8 lb. per square foot on the projected area of the ice-coated cable. Similarly the ½-in. double-galvanized, high-strength crucible-steel ground wire will have a maximum tension of 5,500 lb. under the same conditions.

On the other line the conductors are No. 4/0 aluminum cables steel-reinforced. The maximum tension under conditions given above will be 4,000 lb. Similarly the ⅜-in. double-galvanized, high-strength crucible-steel ground wire will have a maximum tension of 5,500 lb.

The ground wires are spliced by means of special copper McIntyre sleeves heavily tinned on the inside.

Some changes have been made in various features of tower designs and specifications for future lines of the same general type as described above. There will be under construction during the coming year about 175 miles of lines of this character. The principal modifications from the construction described consist in the use of structural-steel anchors for all towers except railroad-crossing towers and in the limitation of 5,000 lb. as maximum cable tension in the conductors instead of the 6,500 lb. in the original specifications.

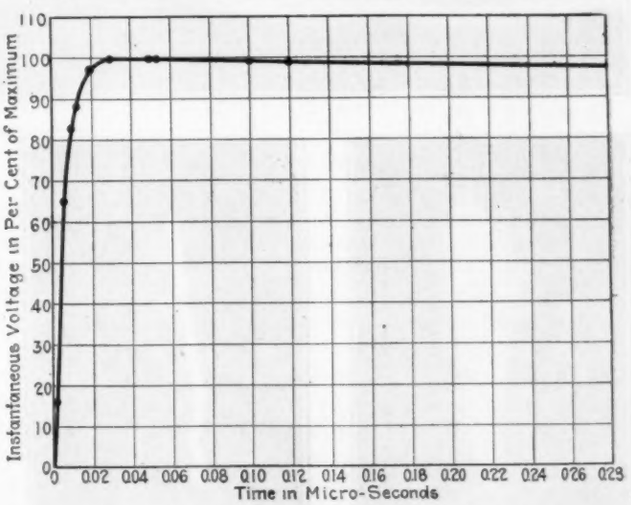
Production of Lightning Voltage and Its Significance

Impulse Generator Develops Voltage at the Rate of Fifty Million Million Volts per Second—Hazard of Omitting Shields

BY F. W. PEEK, JR.
Consulting Engineer General Electric Company

IN STUDYING the effects of lightning on transmission lines and such apparatus as transformers, lightning arresters and so forth it is important to be able to produce lightning voltages in the laboratory closely approximating those occurring in practice.

An investigation of the lightning voltages induced on transmission lines has shown that during any storm many discharges take place on gaps set for lower voltages. The discharges become less and less frequent for the higher settings, and finally very few are found that exceed about 400 kv. However, higher voltages do occur occasionally. Another check on the voltage is the fact that insulator strings of seven or eight units rarely flash over during lightning storms. Lightning voltages or impulses are known to be of very steep wave front,



RATE AT WHICH THE VOLTAGE IS APPLIED BY IMPULSE GENERATOR

which has the effect of increasing the voltages across an insulator or other apparatus at the rate of millions of volts per second.

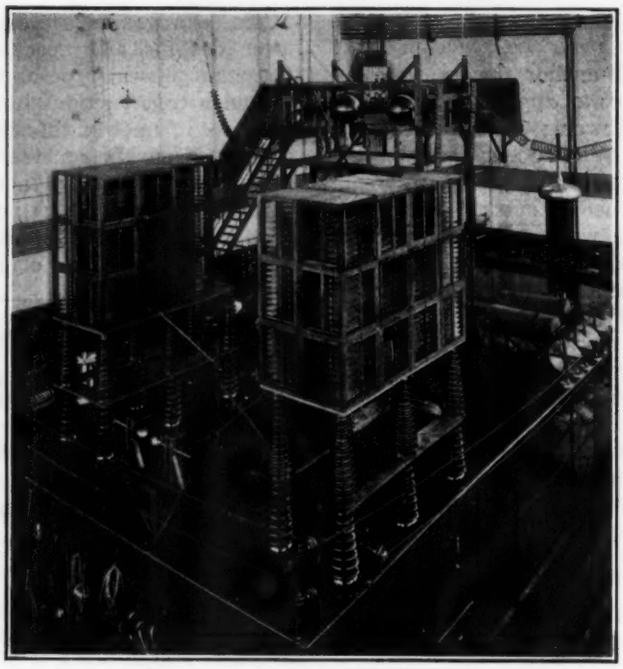
A few years ago a 200-kv. impulse or lightning generator was built to give lightning voltages of predetermined characteristics.* The time lag of various gaps was carefully measured and the term "impulse ratio"

*Peek, F. W., Jr., "The Effect of Transient Voltages on Dielectrics," *Transactions A. I. E. E.*, 1915, Vol. 34, page 1857.

resulted. This generator has been added to from time to time as higher exciting voltages have become available.

An increase to almost 750 kv. was made in 1916, while within the last year an increase to approximately two million volts has been made. It is not the intention to give details of the apparatus here, since these data as well as a description of the method of measuring voltage may be obtained from the paper mentioned above.

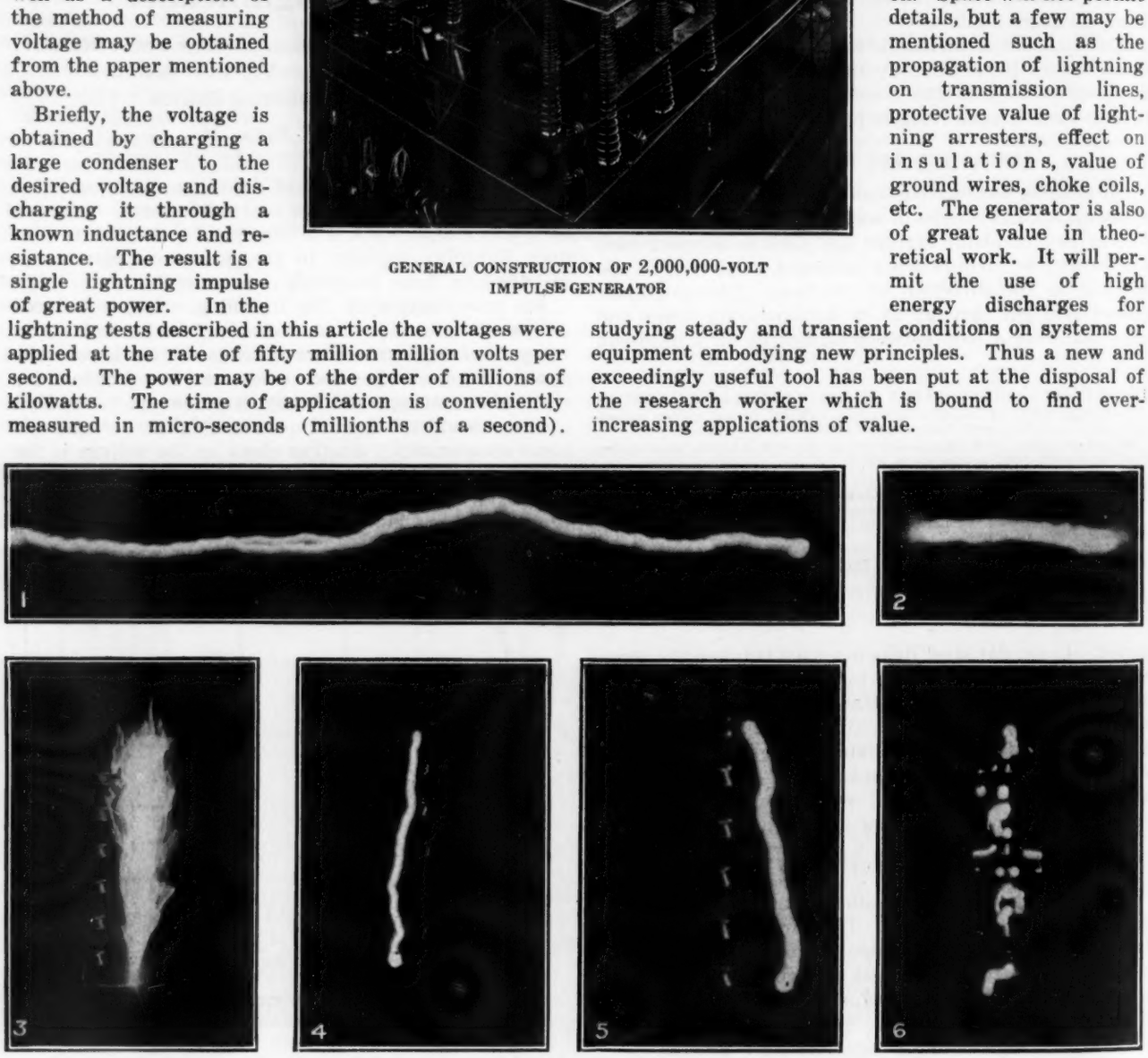
Briefly, the voltage is obtained by charging a large condenser to the desired voltage and discharging it through a known inductance and resistance. The result is a single lightning impulse of great power. In the lightning tests described in this article the voltages were applied at the rate of fifty million million volts per second. The power may be of the order of millions of kilowatts. The time of application is conveniently measured in micro-seconds (millionths of a second).



GENERAL CONSTRUCTION OF 2,000,000-VOLT IMPULSE GENERATOR

This type of discharge must not be confused with the high frequency obtained from an oscillator. In the lightning generator the discharge of energy is so rapid that the resultant spark is "explosive," and accompanied with a loud sharp report or crack.

Practical investigations similar to these illustrated are being carried on. Space will not permit details, but a few may be mentioned such as the propagation of lightning on transmission lines, protective value of lightning arresters, effect on insulations, value of ground wires, choke coils, etc. The generator is also of great value in theoretical work. It will permit the use of high energy discharges for studying steady and transient conditions on systems or equipment embodying new principles. Thus a new and exceedingly useful tool has been put at the disposal of the research worker which is bound to find ever-increasing applications of value.



TYPICAL DISCHARGES FROM THE IMPULSE GENERATOR. LOWER VIEWS SHOW FLASHOVERS ON INSULATORS

No. 1 — Million-and-a-half-volt lightning spark between needle points. Note that the discharge takes a zigzag path very similar to that of lightning.

No. 2—Lightning spark between spheres —the arc is about 3 in. in diameter; the current in the arc approximately 10,000 amp.

No. 3—Dry 60-cycle sparkover of a shielded insulator string. It is very important to know if lightning voltages will clear the string in the same way. Heretofore impulse voltages sufficiently high to spark over a string have not been available. Fig. 4 gives the desired information.

No. 4—1,200,000-volt stroke on dry shielded insulator string. The impulse goes to the shield and clears the string. This test was made in the dark. The photograph of the insulators was due to the spark lasting less than a millionth of a second. A still more important photograph is that shown in Fig. 5.

No. 5—1,200,000-volt stroke on shielded insulator string during heavy rain. The lightning spark clears the string in a heavy rain. The shield does not reduce the lightning sparkover voltages; neither does the rain. The display in the wet test is due to the reflection on the raindrops. Since the light producing this photograph lasted less than a millionth of a second, the illuminated drops appear stationary in space.

No. 6—Lightning sparkover (1,200,000 volts) of a dry non-shielded string. This is an undesirable condition since the skirts may be ripped off.

Superpower Survey of Pacific Northwest

Engineering Investigators Find that Existing Interconnected Power Systems Will, Through Natural Expansion, Prove Adequate for Many Years to the Needs of That Part of the Country

THE report of the engineers who, as representatives of various engineering organiations and chambers of commerce of Washington, Oregon and Idaho, undertook a two-year survey of electrical development in those states with reference to the desirability of a superpower system for the Pacific Northwest does not advocate taking any present steps in such a direction. As was stated in the ELECTRICAL WORLD of April 14, immediately after the report was made public, the engineers who made the survey are of the opinion that the vast and already interconnected systems of this great district will be sufficient, through natural expansion, to take care of future growth for many years to come without the need of developing a superpower system from which they would all alike derive energy.

The great water-power possibilities of the Pacific Northwest, says the report, and their relation to its general development can hardly be overestimated. In other parts of the United States the limitations of water-power development are being sensibly approached, because the cost of power from many undeveloped sources would be so great that it would not compare favorably with the cost of power produced by fuel. The Pacific Northwest is subject to no such limitation, and the abundance and reliability of its water powers is a vital factor in its commercial, agricultural and industrial expansion, which as yet has hardly begun.

In the early days of power generation, the report continues, interruption of service was a serious factor. With the growth of the power business this factor has become greatly minimized through interconnection of individual systems and the establishment of a network of transmission lines of sufficient capacity to perform emergency service in case of a local breakdown. It is these networks of lines of varied capacity which have permitted a division of the entire field considered into five groups. Within each group every reasonable precaution is being taken to avoid interruption of service. The assurance that now exists against such interruption would not be materially enhanced by the construction of superpower lines.

EQUALITY OF EXISTING RATES AND CONDITIONS

General competitive conditions have brought reasonable equality in rates in the Pacific Northwest, the report continues. So far as any differences exist, they could not be eliminated by the construction of superpower lines, because the burden of their cost would fall upon the groups least favorably situated in this respect and would be reflected in the cost of the power delivered. A resultant lowering of rates in any one group, therefore, could be expected only if the difference in cost of group production were sufficiently great to exceed by a considerable amount the cost of providing superpower lines. This is not the case in any one instance. There is, however, an advantage in the exchange of power between groups in minor quantities which explains the construction now proceeding in various directions of group connections by ordinary transmission lines of moderate capacity such as do not come in the class of superpower lines.

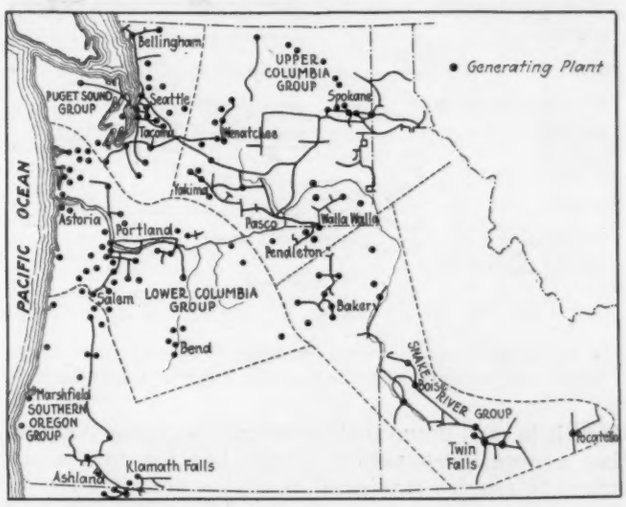


FIG. 1—GENERATING PLANTS AND TRANSMISSION SYSTEMS OF THE PACIFIC NORTHWEST AS OF MAY 1, 1923

A general benefit from superpower lines might be realized in all groups in case a seasonal excess of available hydro-electric power over market requirements in one or more groups coincided with a shortage in other groups, thus permitting wholesale seasonal interchange and resulting in an improved load factor for all. Climatic conditions in all groups so far as they control stream flow and seasonal excess over primary or all-year power are, however, in the main alike. There are some differences as to times when floods occur east and west of the Cascade Mountains, but these are differences of a minor character and are not such as to require or permit a large exchange of power were superpower lines built.

To those familiar with Northwestern power conditions it has long been apparent that the most valid

TABLE I—AVERAGE LOAD CONDITIONS BY GROUPS—1921

Group	Average Load, Kw.	Peak Load, Kw.	Annual Load Factor, Per Cent
Puget Sound	68,000	156,000	44
Lower Columbia	50,000	92,000	54
Southern Oregon	17,000	25,000	68
Upper Columbia	51,000	82,000	62
Snake River	24,000	37,000	65
All groups	210,000	392,000	54

TABLE II—TOTAL POWER GENERATED—1921

Group	Power Generated—Kilowatt-Hours— Steam	Hydro	Total	Steam Percentage Of Total
Puget Sound	30,493,000	561,534,000	592,027,000	5.2
Lower Columbia	73,410,000	360,416,000	433,826,000	16.8
Southern Oregon	11,350,000	152,020,000	163,370,000	6.9
Upper Columbia	61,000	443,838,000	443,899,000	.015
Snake River	1,260,000	202,018,000	203,278,000	1.6
All groups	116,574,000	1,719,826,000	1,836,400,000	6.3

reason for considering superpower connection at all must be sought in the variation throughout the year of power demands as compared with hydro-electric power supply, and it was this phase of the subject which received most careful consideration. The group load factors are, on the whole, favorable, and they can and will undoubtedly be improved by hydro-electric development within each group and by the use of storage. Superpower connection is not believed to be necessary for this purpose.

The question was considered whether in the future the number of possible power developments may not be reached in one group long before it is reached in other groups and whether at such a time a superpower connection may not be warranted or even essential to assure healthy expansion in all the groups. The investigators hold that water-power possibilities are so abundant and so evenly distributed over the entire territory, and that

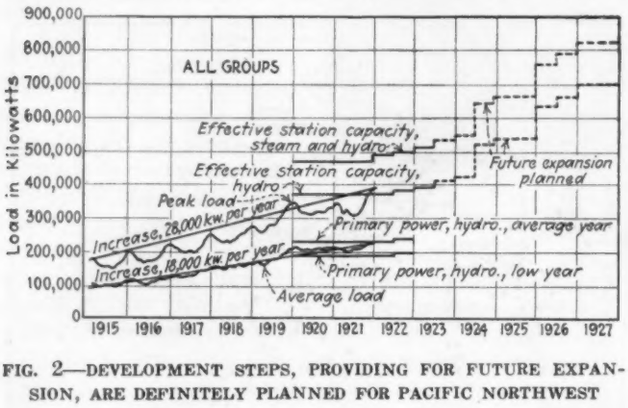


FIG. 2—DEVELOPMENT STEPS, PROVIDING FOR FUTURE EXPANSION, ARE DEFINITELY PLANNED FOR PACIFIC NORTHWEST

there is in each group such an enormous excess available that a group shortage of supply lies too far in the future to require consideration at the present time.

Fig. 2 gives the average load and the maximum load per month (one month) and the provisions planned to meet future demands of the entire Northwest. The terms which are used in Fig. 2 have the following significance:

"Effective station capacity" is the capacity of generation of the installed equipment in kilowatts. It is usually the capacity of the generators for a continuous run of one hour as limited by turbines or boilers, or the generators themselves, but not by water supply.

"Primary power, average year," is the effective station capacity of hydro-electric plants as limited by water supply during the average water year.

"Primary power, low year," is the effective station capacity of hydro-electric plants as limited by water supply during a low-water year.

The total average rate of generation in 1921 for all groups was 210,000 kw. and the peak load was 392,000 kw., giving an annual load factor of 54 per cent.

The committee's carefully studied conclusions are summarized in its report.

TABLE III—SUMMARY OF RATE OF GROWTH IN POWER DEMAND

Group	Period	Increase per Year, Kw. Average Load	Increase per Year, Kw. Peak Load
Puget Sound	1915–1921	5,700	12,400
Lower Columbia	1915–1921	4,000	5,700
Southern Oregon	1915–1918	400	400
Southern Oregon	1919–1921	2,200	2,200
Upper Columbia	1915–1918	1,500	2,500
Upper Columbia	1919–1921	5,000	5,000
Snake River	1915–1921	2,500	2,800
All groups	1915–1921	18,000	28,000

"1. There is a healthy increase of power demand in all groups.

"2. Adequate provisions are under way in all groups to keep ahead of the estimated growing demand by the construction of hydro-electric plants and water storage. In the groups where steam power production is now an important element plans provide for reduction of the proportionate amount of power supplied by steam.

"3. The characteristics of the power load of each group are much the same, the maximum load occurring in the fall and winter, except in the Snake River group, where irrigation pumping produces a summer peak.

"4. The need of group connection by superpower lines is at present not sufficiently great to justify the expense even in the case of a line between the Snake River and Upper Columbia groups, where the advantage would be greatest.

"5. The power which can be economically exchanged between the several groups can be carried over ordinary transmission lines already built or likely to be built in the future.

"6. Existing networks of power systems will, through natural expansion, become more closely interconnected, but superpower lines are not likely to be needed unless economical development in one group reaches its limit while great excess of power exists in other groups. Such a condition is not likely to obtain for many years.

"7. Future large hydro-electric power development, in addition to that provided by existing systems normally expanding, is dependent upon the introduction of commercially feasible agricultural or industrial enterprises requiring large amounts of power.

"8. Such power development is of the highest importance to the Northwest. If wisely undertaken, it will come as a result of newly created markets, will tend to benefit other public utilities and stabilize rates, but will not in itself require superpower connection.

"9. Thirty-eight per cent of the water-power possibilities in the United States are situated in the area under discussion. The development work up to the present time has in the main been consistently carried along without unnecessary duplication. The expense of superpower construction, which must be incurred in other regions to save fuel or to equalize unbalanced power conditions, can be avoided for a long time in the Pacific Northwest. Superpower lines may, however, become of importance at an early date to carry power from our abundance to less favored regions to the south and east."

TABLE IV—PROBABLE EFFECTIVE STATION CAPACITY

Group	Peak Load	Probable Future Effective Station Hydro and Steam Capacity in Thousands of Kilowatts at End of Year				
	1921	1923	1924	1925	1926	1927
Puget Sound	156	192	248	248	332	332
Lower Columbia	92	115	154	154	179	204
Southern Oregon	25	33	33	43	45	45
Upper Columbia	82	135	143	143	156	156
Snake River	37	54	54	63	63	74
All groups	392	529	632	651	775	811

TABLE V—TOTAL RATING OF PLANTS IN OPERATION MAY 1, 1923

Group	Number of Operating Companies	Number of Generating Plants	Installed Generator Rating in Hp. Steam Plants	Hydro Plants
Puget Sound	12	24	102,560	202,250
Lower Columbia	28	50	81,500	109,600
Southern Oregon	12	20	12,570	58,290
Upper Columbia	20	34	9,940	198,690
Snake River	6	18	700	79,900
All groups	78	146	207,270	648,730

Economies of Complete Electrification in Large Buildings

In Closing Down Private Plants Auxiliary Steam Equipment Should Be Electrified to Afford Maximum Saving to Customer—This May Exceed All Other Loads—Value of Exhaust Steam Overestimated

By W. H. WHITTON
New York Edison Company

A PRODUCTIVE field for extending the use of electricity, much to the advantage of both the supplying company and the consumer, exists in many large buildings which still have extensive equipments of steam apparatus, even though central-station service is used for other purposes. This condition is most commonly found where private generating plants have been superseded by purchased power, the substitution being unaccompanied, however, by any change to the attendant steam equipment.

It has been the experience of one large central-station company that a building which thus uses street service for its electrical requirements and at the same time produces steam for power to operate other equipment is run at needlessly great expense. The reason of this seems fairly obvious. Of the entire equipment of steam machinery found in the modern isolated plant, the engine-generators are usually by far the most efficient, and their discontinuance and the retention of other steam apparatus leaves in service the part of the equipment that not only is the most wasteful but that demands the greatest degree of attention.

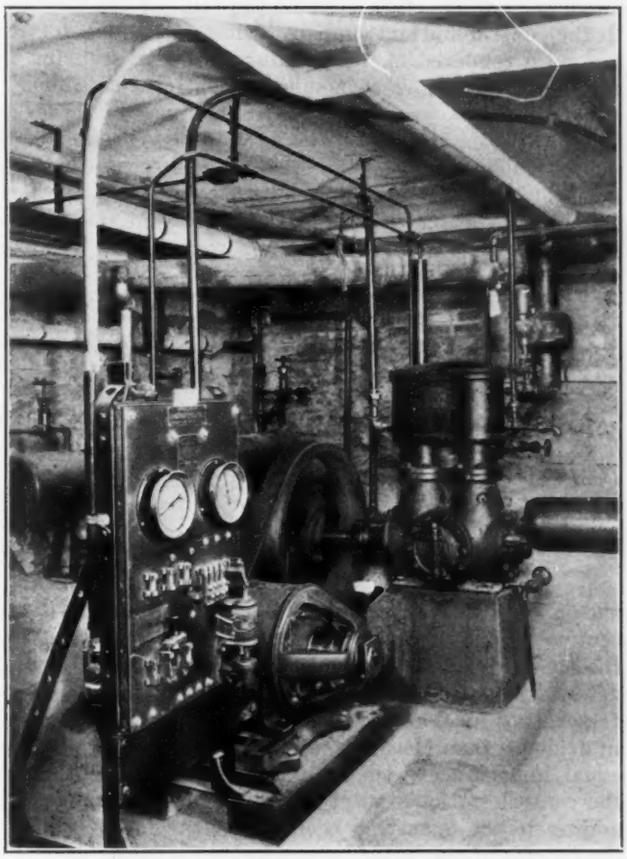
The abandonment of generating units only, leaving other steam apparatus, such as elevators, pumps, compressors and auxiliary equipment, to be supplied from the building's boilers, usually has little effect, and sometimes none, on certain important items of expense, even though others are substantially reduced. Governed by local conditions, these reductions may or may not be sufficient to pay for the purchase of the electricity formerly generated locally, but it has been observed that the results are not nearly so satisfactory as where complete electrification is carried out, permitting wide-reaching economies in all directions. The fuel savings exceed those of the less complete change by much more than is represented merely by the former requirements of the steam machinery, the wastages in steam piping, traps and so forth in many plants with steam auxiliaries reaching as high as from 20 per cent to 25 per cent of the entire fuel consumption. The greater part of these wastages can by proper measures be eliminated.

From the central-station point of view, the complete electrification, as compared with the generator abandonment alone, presents very great advantages. It not only tends to add greatly to the satisfaction of the customer, but the income to the central station company is in many instances increased by a very material percentage, the exact amount, of course, depending on the extent of the former steam equipment. In hotels, where the changes from steam to electric drive may include elevators, house pumps, boiler-feed pumps, refrigerating machinery, brine pumps, air compressors, blowers, sump pumps, circulating pumps and kitchen machinery, the newly created electrical requirements may even exceed those formerly existing; that is, the consumption of electricity may be more than doubled.

This is illustrated in Table I, which is an analysis of the electrical usages in a hotel in which the generators were shut down, electric pumps were installed to operate the hydraulic elevators, and electric machines substituted for the remainder of the steam apparatus.

TABLE I—CONSUMPTION OF ELECTRIFIED HOTEL EQUIPMENT AND ELECTRO-HYDRAULIC ELEVATORS

	Kw.-Hr. One Year	Percentage of Total
Elevator pumps	287,210	32.7
House pumps	66,925	7.7
Boiler-feed pumps	4,565	.5
Sump pumps	1,344	.2
Refrigerating machine	154,390	17.6
Brine pumps	56,206	6.4
Light and miscellaneous	306,400	34.9
Total	877,040	100.0



ELECTRICALLY OPERATED REFRIGERATING MACHINE

TABLE II—CONSUMPTION OF ELECTRIFIED HOTEL EQUIPMENT AND STRAIGHT ELECTRIC ELEVATORS

	Kw.-Hr. One Year	Percentage of Total
Elevator (passenger)	10,456	4.5
Elevator (passenger)	11,933	5.2
Elevator (freight)	5,568	2.4
House pumps	2,878	1.3
Refrigerating machine	63,350	27.3
Brine pump	25,329	10.9
Circulating pump	4,246	1.8
Light and miscellaneous	107,990	46.6
Total	231,750	100.0

In this hotel the electrified apparatus consumes about 65 per cent of the total energy supplied and the original electrical equipment about 35 per cent. In other words, complete electrification rather than simple generator abandonment has almost tripled the value of the business to the central-station company, while a genuine service has been rendered to the building owner in securing to him better and more economical operating conditions.

Table II shows values corresponding to those in Table I, the data, however, being obtained in a considerably smaller hotel with straight electric elevators. Owing to the fact that the elevators in this hotel were electric, the amount of new equipment and the energy consumed by it are relatively less than in the building shown in Table I. Of the total consumption, 41 per cent is used by the new equipment and 59 per cent by the old—a result which shows the importance of giving detailed attention to apparatus such as pumps and refrigerating machines, which, although less prominently in evidence than elevators, are in many cases of perhaps equal importance from both the property owner's and the central station's point of view—their electrification adding to the operating economy of the former and to the income of the latter.

Undoubtedly the installation of so much steam machinery in cities where the artificial heating of buildings is necessary during a substantial part of the year is due to the belief that this heat can be most economically furnished by the steam exhausted from the piston apparatus. The usefulness of exhaust steam for this purpose, as well as for water heating, has been greatly overestimated by many. Much of it is not available, and the rest can be utilized for building heating only during the winter months, and then but seldom to the full extent, as may be realized from observation of the wide range of temperatures occurring during the heating season. In the average building having a private plant the amount of exhaust steam made is fairly uniform from day to day, while the heating demands fluctuate widely, varying inversely as the outside temperature. This relation is shown clearly in the accompanying diagram, plotted from data obtained during the test of a large private plant in New York City.

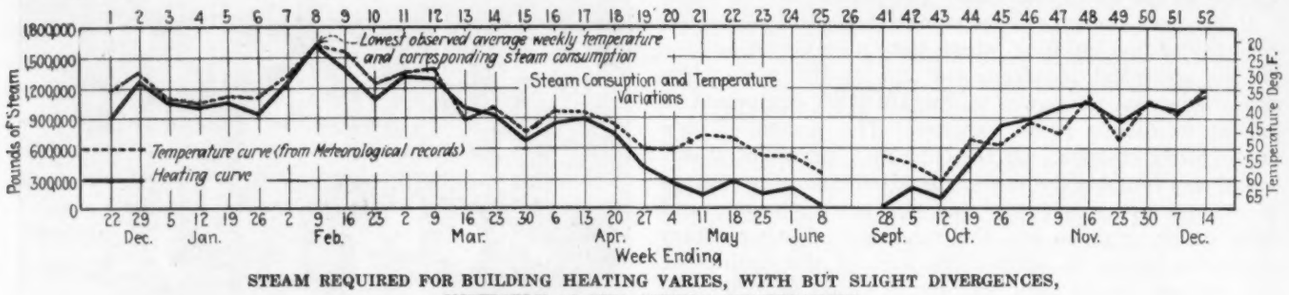
Complete observations and measurements of the same plant, made over the period of an entire year, indicate how little, relatively, of the total steam produced could be utilized for building heating. The results are shown in Table III.

Here the exhaust steam used for heating was 39.3 per cent of the exhaust made, or 32 per cent of the total steam produced. Of the exhaust available for heating, only 52.3 per cent could be utilized for that purpose, the remainder being made at times when the supply exceeded the demand. Much of it was therefore wasted to the outer air, while a material percentage was lost in the foul drips, etc.

This test, during which the amount of steam distributed to each piece of apparatus was accurately measured during the year, will also serve to illustrate the relatively heavy steam requirements of the equipment other than the engines, a matter previously referred to. The values are shown in Table IV.

Analysis of these test results, which are fairly representative of a well-run plant, shows that the engines utilized about 44.4 per cent of the total steam produced and that 55.6 per cent was required for other equipment, for heating, or was wasted. The inadequacy of a policy which might simply contemplate the abandonment of the generating units, permitting the other apparatus to continue in operation, will be appreciated from these figures, which also convey some idea of the value of the field from the viewpoint of increased electrical sales.

The unsatisfactory results which may follow a partial change of the kind referred to, even though the steam equipment remaining in operation be small, may be realized from the example of a manufacturing building in which the abandonment of the generators was not accompanied by any readjustment of the other


Lowest observed average weekly temperature and corresponding steam consumption
Steam Consuption and Temperature Variations
Temperature curve (from Meteorological records)
Heating curve
Pounds of Steam
Temperature Deg. F.
Week Ending
Dec. Jan. Feb. Mar. Apr. May June Sept. Oct. Nov. Dec.

STEAM REQUIRED FOR BUILDING HEATING VARIES, WITH BUT SLIGHT DIVERGENCES, INVERSELY AS THE OUTSIDE TEMPERATURE

TABLE III—UTILIZATION OF EXHAUST STEAM IN A PRIVATE PLANT AS DETERMINED BY ACTUAL TEST

		Lb.
Total steam produced		81,656,986
Total exhaust steam made		69,116,887
Exhaust steam not available:		
Foul drip loss	16,529,016	
Condensed in house heater	1,548,050	
Drawn by ejectors	252,014	
Condensed by ice machine	875,964	
		19,205,044
Exhaust steam available		49,911,843
Exhaust to roof stack		23,852,060
Exhaust steam used for heating		26,125,494
Live steam used for heating		3,202,890
Total steam used for heating		29,328,384

TABLE IV—DISTRIBUTION OF STEAM IN A PRIVATE PLANT AS DETERMINED BY ACTUAL TEST

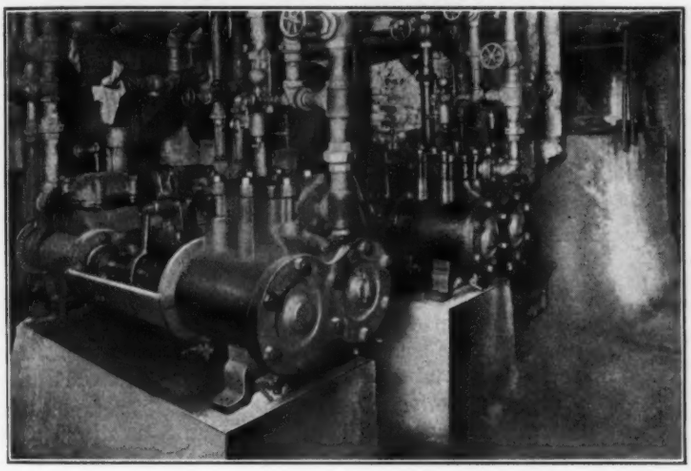
Steam to	Lb.	Steam to	Lb.
Engines	36,275,352	Vacuum pumps	2,375,711
Auxiliary pumps	8,416,425	Ejectors	1,225,421
House pumps	5,178,284	House heater	334,141
Ice machine	1,956,469	Paul board	266,936
Elevator pumps	12,509,868	Clean drips	8,736,125
Return pumps	1,179,357	Reducing valves	3,202,897
Total steam made			81,656,986

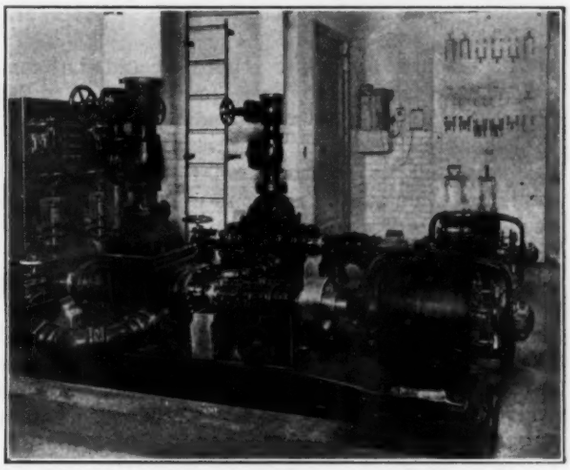
steam services. With the full plant in operation, the cost of producing light, power and heat had been about $33,000 yearly. With the generators closed down and electricity purchased, the cost was increased to about $35,000 yearly. A careful study of the causes of this unsatisfactory showing resulted in the substitution of several electric pumps for steam ones, increasing the electrical consumption by less than 4 per cent, and a complete rearrangement of the steam system which this change permitted. So extensive were the resultant economies that the operating costs were reduced to $23,000 yearly—a saving of $10,000 when compared with the plan of part central-station service and part locally produced power.

The results also call attention to the importance, if the full economies possible with central-station service are to be realized, of having expert steam engineering advice in planning the readjustment of the steam services. This is especially true in factories, where high-pressure steam may be required for industrial processes; in hotels, where cooking and perhaps laundry requirements are heavy, and in clubs and other buildings where similar conditions prevail. In the kitchen either gas or electricity, where the rate justifies it, can be substituted for steam, although in some instances it may be found advisable to adapt the kitchen equipment for operation with low-pressure steam. In the laundry the principal problem is the mangle; the smaller-sized machines can be successfully heated by gas, but for the larger sizes high-pressure steam seems a necessity.

Perhaps the best method of treatment is to install a small boiler, of the proper capacity and pressure, heated either by gas or coal as seems advisable. Under ordinary price conditions gas presents great advantages. Where the high-pressure steam requirements are sufficiently great, it may be found advisable, instead of installing a small new boiler, to devote one of the boilers formerly used for power purposes to the production of high-pressure steam, perhaps segregating the high-pressure system from the low-pressure system used for heating the building. A closed system of this kind reduces the heat losses to a minimum, eliminates many complications, and is both economical and convenient.

In the average building a complete steam and electrical changeover naturally involves a considerable outlay of money, one sufficiently great to explain the reluctance of many property owners to face the undertaking. The elevators usually constitute by far the largest item of expense — assuming that a complete change from hydraulic to electric power is made. In a building of substantial size having a number of elevators the investment may well run into thousands or even hundreds of thousands of dollars, a matter of very considerable concern to the property owner. Where the question of initial expenditure is an obstacle the installation of electric elevator pumps to replace those driven by steam may solve the problem. The cost of making the change is very much less, and while the consumption of energy may run from two to two and one-half times as much as with straight electric elevators, the saving in the fixed charges of interest, depreciation, and so forth may be sufficient not only to pay for the additional use of energy, but to compensate for the other items of expense which would be reduced if straight electric elevators were employed.





TYPICAL INSTALLATIONS OF STEAM PUMPS AND MOTOR-DRIVEN HOUSE PUMPS

There is probably no class of building equipment which suffers greater neglect and operates at poorer efficiency than steam pumps. The equipment shown was afterward superseded by an installation of motor-driven pumps.

Electric house pumps of 150-g.p.m. capacity, each operated by a 10-hp. motor. These units replaced the steam pumps in a large bank building when the private plant was abandoned and central station service installed.

The mileage and kilowatt-hour values obtained during elevator tests in three office buildings each with four hydraulic elevators the pumps for which were recently changed from steam to electric will serve to illustrate the requirements of electro-hydraulic equipment. The test results appear in Table V.

It may be of interest to compare with the foregoing the test results obtained on four typical elevators in one of the latest of New York's large office buildings. They appear in Table VI.

TABLE V—KILOWATT-HOURS PER CAR-MILE AS DETERMINED BY TESTS OF TWELVE ELECTRO-HYDRAULIC ELEVATORS

	Building No. 1			Building No. 2			Building No. 3		
Week	Car-Miles	Kw.-Hr.	Kw.-Hr. per Car-Mile	Car-Miles	Kw.-Hr.	Kw.-Hr. per Car-Mile	Car-Miles	Kw.-Hr.	Kw.-Hr. per Car-Mile
First	327.1	3,427	10.48	299.7	2,567	8.57	239.0	2,570	10.75
Second	320.9	3,530	11.35	296.4	2,530	8.54	256.4	2,560	9.98
Third	291.0	2,844	10.12	259.3	2,324	8.96	208.6	2,180	10.45
Fourth	327.2	3,376	10.32	282.4	2,585	9.15	255.3	2,610	10.22
Fifth	335.6	3,452	10.28	288.6	2,661	9.22	254.6	2,560	10.06
Sixth	347.8	3,593	10.32	286.9	2,678	9.32	239.9	2,500	10.41
Seventh	341.0	3,260	9.56	286.2	2,671	9.33	256.2	2,670	10.41
Eighth	333.0	3,250	9.76	279.0	2,624	9.40	248.0	2,630	10.60
Total	2,623.6	26,732	10.19	2,278.5	20,640	9.06	1,958.0	20,280	10.36

TABLE VI—KILOWATT-HOURS PER CAR-MILE AS DETERMINED BY TESTS OF FOUR GEARLESS TRACTION ELEVATORS

Week	Elevator No. 1			Elevator No. 2			Elevator No. 3			Elevator No. 4		
	Car-Miles	Kw.-Hr.	Kw.-Hr. per Car-Mile	Car-Miles	Kw.-Hr.	Kw.-Hr. per Car-Mile	Car-Miles	Kw.-Hr.	Kw.-Hr. per Car-Mile	Car-Miles	Kw.-Hr.	Kw.-Hr. per Car-Mile
First....	101.0	450	4.46	117.9	390	3.31	132.8	530	3.99	153.8	488	3.17
Second..	85.4	370	4.33	86.7	300	3.46	110.5	448	4.06	135.0	445	3.29
Third...	82.7	360	4.35	114.0	370	3.24	128.0	542	4.24	153.0	484	3.17
Fourth..	93.5	410	4.39	97.0	400	4.12	128.1	519	4.05	158.4	502	3.17
Fifth....	95.3	420	4.39	67.9	400	5.89	127.5	539	4.23	161.6	507	3.14
Sixth....	90.0	410	4.55	81.2	390	4.80	131.7	522	3.96	158.7	494	3.11
Total..	547.9	2,420	4.42	564.7	2,250	3.98	758.6	3,100	4.09	920.5	2,920	3.17

The rate of progress to be made in the further establishment of the principle of 100 per cent electrification will largely depend upon the efforts put forth in this direction by central-station interests. There are no other agencies equally concerned, nor any others so well situated to demonstrate the merits of all-electric machinery operating in connection with low-pressure steam systems.

At frequent intervals there should be something of interest to tell to every owner of a building in which such changes might advantageously be made. He should be made to comprehend the nature of the problem and its solution and to understand that the central station stands ready to undertake any necessary tests and studies of operating costs, to have specifications prepared for both electrical and steam changes, and to co-operate in every possible way in determining the best course to follow. If during the period of readjustment that inevitably follows the execution of changes as complete as those discussed the central-station company will keep in touch with the situation and be prepared to make such tests, observations and suggestions as will be of assistance in bringing about the most satisfactory operating conditions, the complete success of the venture will be assured.

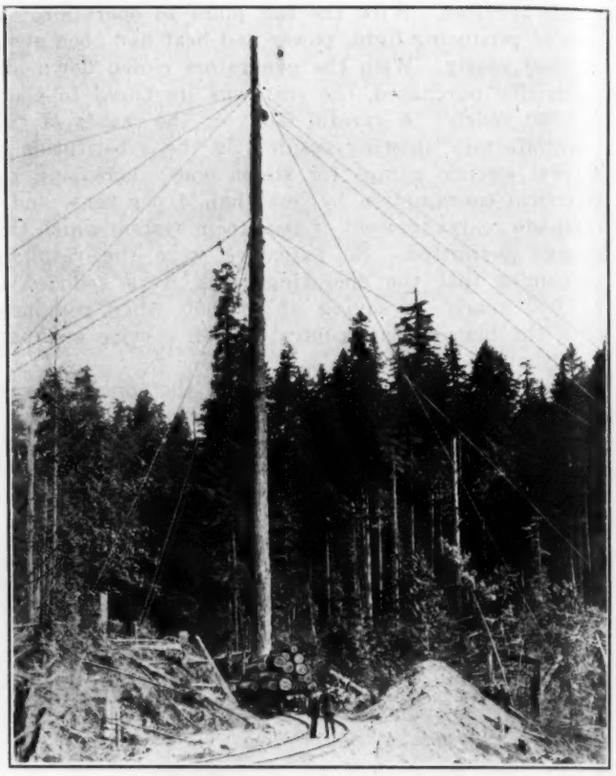
Increased Logging Speeds with Electric Donkey Engines

INCREASE in logging speed of 125 per cent and decrease in the cost of the operations have been accomplished together in the Pacific Northwest by the replacement of steam-driven donkey engines by electric motor-driven engines. In some instances—notably with the Snoqualmie Falls Lumber Company of Snoqualmie Falls, Wash.—combination yarding and loading units have been placed in operation and have proved far superior to steam-driven sets. Such a machine, having the yarder equipped with a 300-hp., 585-r.p.m., 550-volt motor and the loading machine equipped with two 75-hp., 580-r.p.m., 550-volt motors, has shown itself on test capable of handling 2,000,000 board feet of lumber per month.

In addition to the savings from the increased speed of operation, a great saving is made possible by doing away with the laying of pipes to supply water for the boilers of steam donkey engines. An additional saving in maintenance results from the elimination of the materials and labor for repairing the brickwork and tubes of the boilers.

DIVISION OF YARDING AND LOADING OPERATIONS

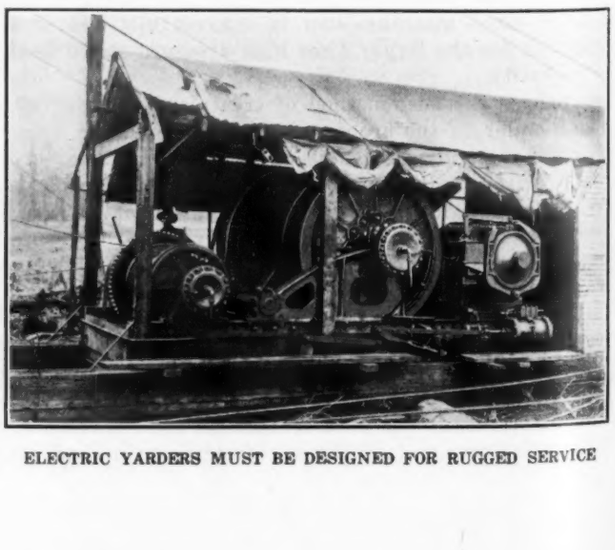
	Percentage of Total Costs		Percentage of Total Costs
Labor	16.6	Haulage ropes	4.9
Repairs	2.0	Supplies	2.3
Fuel	1.2	Fixed charges	6.9
Rigging trees	2.0		
Percentage of total costs			35.9



TREES ARE USED IN YARDING OPERATIONS

Power for operating the electric units is distributed at 10,000 volts or 15,000 volts over inexpensive lines constructed with a realization of the temporary nature of the application. On the experience of the last few years' operating costs, electric drive can compete favorably with steam even with power costing $0.015 per kilowatt-hour and distributed as far as 7 to 10 miles through the woods.

Yarding and loading operations make up nearly 36 per cent of the total operating cost, neglecting stumpage, and these items are subdivided as shown in the table. This high proportion of the total expense indicates that the greatest economies in logging operations may be gained by electrification of the yarders and loaders.



ELECTRIC YARDERS MUST BE DESIGNED FOR RUGGED SERVICE

Full-Automatic Hydro-Electric Station

Adopted by New England Power Company for Relatively Inaccessible Site on Deerfield River—Tied in with Other Stations—Functioning Under Different Conditions Explained

By E. B. COLLINS
Assistant Electrical Engineer New England Power Company

LARGEST FULLY AUTOMATIC GENERATING STATION JUST COMPLETED

THE 5,000-kva. automatic hydro-electric generating station recently installed by the New England Power Company represents a considerable stride in the application of full automatic control. It is situated at Searsburg, Vt., near the headwaters of the Deerfield River in a mountainous, unsettled region which is practically inaccessible during the winter months. Under these circumstances the expense and difficulties involved in maintaining the necessary personnel for the operation of a manual station would have been considerable. Therefore, in order to take the fullest advantage of the natural power site, the operating company decided to install an automatically controlled station.

The station utilizes natural run-off supplemented by water stored about 9 miles up stream. Three miles above the station the water is diverted into a wood-stave pipe, which affords an average operating head of 210 ft. Energy from this plant is fed through a 15-mile, 66,000-volt line into the high-tension bus of another station on the system, where it is metered.

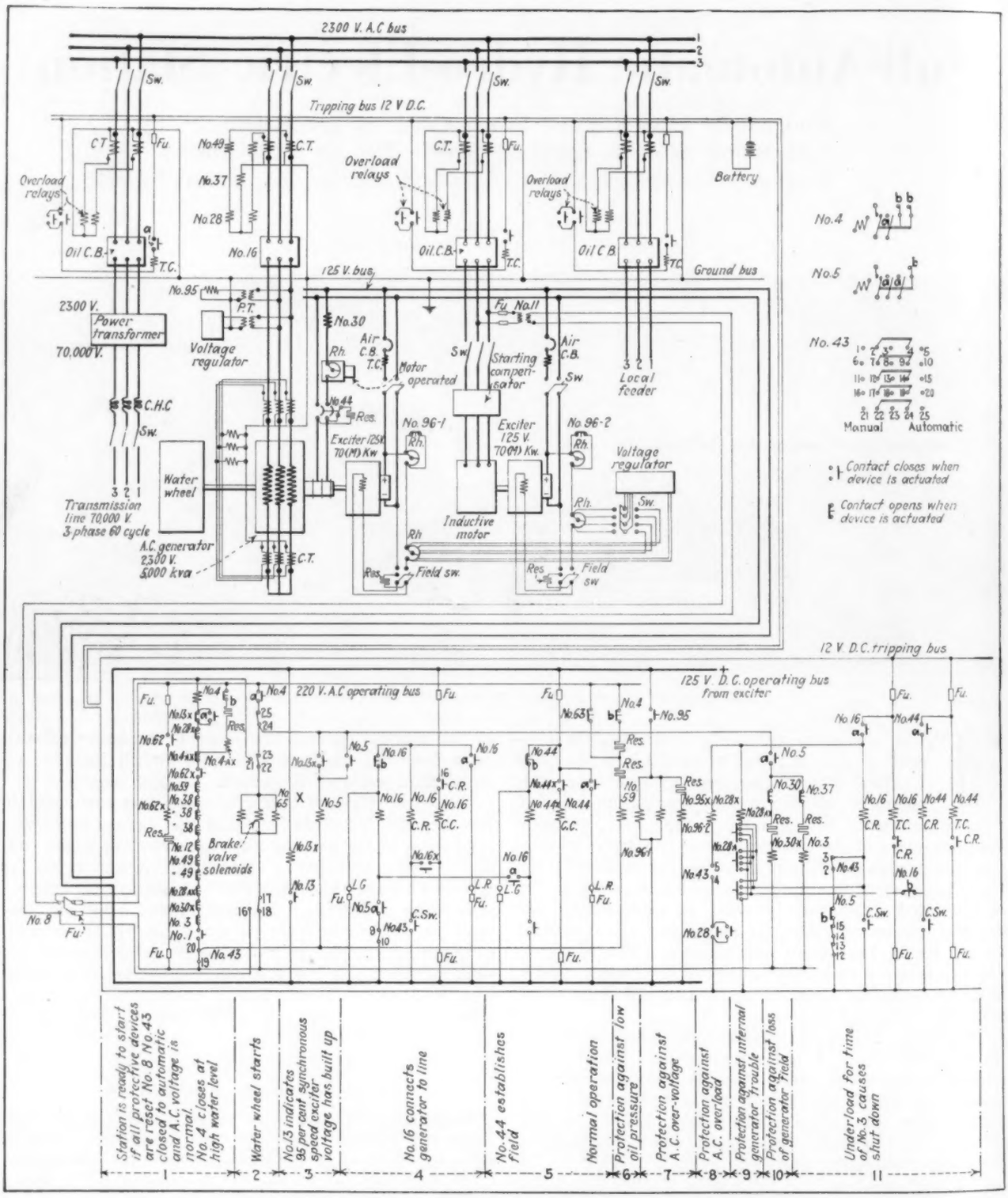
The equipment at the automatic station comprises one 5,000-kva., 2,300-volt, three-phase, 60-cycle vertical waterwheel generator, with directly connected exciter and automatic control equipment furnished by the General Electric Company. The generator is connected to an I. P. Morris waterwheel, which is controlled by a Woodward governor. The energy from the generator is stepped up by means of a 5,000-kva. bank of transformers to 66,000 volts and then transmitted to station No. 5 by means of the above line. The high-tension network is tied in at several points with other systems which serve a large part of New England. The control equipment is arranged for either full automatic or full manual control, the change-over being effected by a five-pole, double-throw knife switch installed on the control panel of the board.

The installation of this equipment was completed in March, 1922, but it so happened that before there was time fully to try out the automatic control, water conditions were such that it was necessary to start up the station at once. Consequently, the station commenced generation under manual operation and 4,800 kw. was placed upon the unit from the start and held there practically without change until tests on the automatic equipment could be made, which was not until the latter part of June. A better test of the abilities of a generating equipment to meet service demand could hardly be devised, and the results on this generating equipment were entirely satisfactory.

FULL-AUTOMATIC FUNCTIONING

Since June the station has been operating under full-automatic control, carrying from one-fourth load to full load, depending on the varying water conditions which obtained on the river. As some of the features of the control and protective equipment are rather unusual, a description of the equipment and its operation should prove interesting. The power to operate the control devices is supplied by a control power transformer connected to the local 2,300-volt feeder, which is taken off the station bus and steps the energy down to 220 volts. The arrangement of the control circuits is shown on page 1144 and the operation is as follows:

With the connecting high-tension line alive from station No. 5 and the change-over switch No. 43 in the automatic position, the control power transformer No. 11 energizes the 220-volt control through the control power


2300 V. A.C bus
Tripping bus 12 V D.C.
Overload relays
Oil C.B.
T.C.
Battery
Ground bus
125 V. bus
2300 V.
Power transformer
70,000 V.
Voltage regulator
Water wheel
Transmission line 70000 V 3 phase 60 cycle
A.C. generator 2300 V. 5000 kva
Motor operated
Starting compensator
Exciter 125 V. 700(M) Kw.
Inductive motor
Local feeder
Field sw.
Manual
Automatic
Contact closes when device is actuated
Contact opens when device is actuated
12 V. D.C. tripping bus
220 V. A.C operating bus
125 V. D.C. operating bus from exciter
Brake valve solenoids
Station is ready to start if all protective devices are reset No 8 No 43 closed to automatic and A.C. voltage is normal. No. 4 closes at high water level
Water wheel starts
No. 13 indicates 95 per cent synchronous speed exciter voltage has built up
No. 16 connects generator to line
No. 44 establishes field
Normal operation
Protection against low oil pressure
Protection against A.C. over-voltage
Protection against A.C. overload
Protection against internal generator trouble
Protection against loss of generator field
Underload for time of No. 3 causes shut down

Schematic Wiring for Automatic Control of Searsburg (Vt.) Hydro-Electric Station

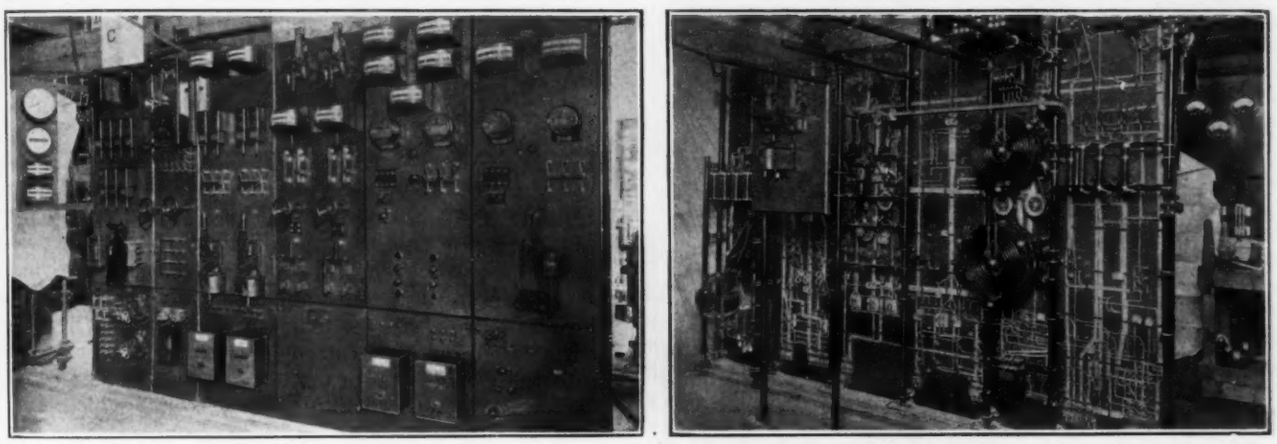
A.—Auxiliary switch, open when main switch is open.
B.—Auxiliary switch, closed when main switch is open.
C.B.—Circuit breaker.
C.C.—Closing coil.
C.R.—Control relay.
C.SW.—Control switch.
C.T.—Current transformer.
CH.C.—Choke coil.
Fu.—Fuse.
L.G.—Lamp green.
L.R.—Lamp red.
P.T.—Potential transformer.
Res.—Resistor.
RH.—Rheostat.
Sw.—Switch.
T.C.—Trip coil.

No.
96—Rheostat short-circuiting contactor.
95-X—Auxiliary relay for No. 95 hand reset.
95—Overvoltage relay.
65—Governor solenoid.
63—Oil pressure relay.
62-X—Auxiliary relay for No. 62.
62—Float switch.
59—Overvoltage relay hand reset.
49—A.C. machine temperature relay.
44-X—Hesitating control relay for No. 44.
44—Generator field circuit breaker.
43—Change-over switch, manual to automatic.
38—Bearing temperature relay hand reset.
37—Underload relay.
30-X—Auxiliary relay for No. 30 hand reset.
30—Field relay.
28-AX—Auxiliary relay for No. 28A hand reset.
28-A—Overload relay for differential protection hand reset.
28-X—Auxiliary relay for No. 28 hand reset.
28—A.C. overload time delay relay.
16-X—Hesitating control relay for No. 16.
16—Running oil circuit breaker.
13-X—Auxiliary relay for No. 13.
13—Synchronous speed control switch.
12—Overspeed limit switch hand reset.
11—Control power transformer.
8—Control power switch.
5—Control current contactor.
4-AX—Notching auxiliary relay for No. 4.
4—Master control contactor.
3—Time delay stopping relay.
1—Master starting element.

switch No. 8. Sufficient oil pressure causes the oil-pressure relay No. 63 to remain open, leaving both steps of resistance in the circuit of the over-voltage relay No. 59, which remains closed if the voltage on the transmission line is not too high.

If the water level in the forebay is above a predetermined level, float switch No. 62 will also be closed. All other protective devices have their contacts in the normally closed position.

When the master control element No. 1 (in this case a time switch operating at a predetermined time) closes the coil of the master-control contactor, No. 4 is energized through the contacts of devices Nos. 43, 59, 3, 30x, 28x, 49, 12, 38 and 62. The closing of No. 4 energizes the governor solenoid No. 65, opening a pilot valve on the gate-operating mechanism, allowing the oil pressure to start opening the gate. At the same time the relief and inlet valves of the brake cylinders are operated by solenoids connected in multiple with No. 65, releasing the brake and allowing the generator to start. An auxiliary switch on No. 4 completes the circuit of a 12-volt battery through the coil of relay No. 28. This battery supplies power to the 12-volt direct-current control circuit, which is completed by the operation of either alternating-current overload relay No. 28 or differential overload relay No. 28a. This circuit supplies power to the trip coils on the generator oil circuit breaker No. 16.



FRONT AND REAR OF RELAY, INSTRUMENT AND AUXILIARY PANELS OF AUTOMATIC HYDRO-ELECTRIC PLANT AT SEARSBURG, VT.

BRING GENERATOR ON LINE AS INDUCTION MOTOR

When the generator comes up to about 95 per cent synchronous speed, synchronous-speed control switch No. 13 closes, energizing control current contactor No. 5, which thereupon closes. The closing of this contactor completes the circuit through the coil of auxiliary field relay No. 30x, which starts to close against a time delay through the contacts of field relay No. 30. The latter are closed until the generator field builds up. The closing of No. 5 also short-circuits No. 13, so that No. 5 is locked in against a momentary loss in speed. Contact is also made by No. 5 through underload relay No. 37 to the time-delay stopping relay No. 3.

Thus two conditions are guarded against, namely, failure of the field to build up and failure of the generator to take load. In the first case, if No. 30 does not open before No. 30x closes, the station will shut down, and in the second, if No. 3 opens, the coil circuit of No. 4 will be broken, de-energizing that contactor and shutting the station down. The first pole on contactor No. 5 completes the circuit through hesitating control relay No. 16x and the B switch on No. 16 to the 125-volt direct-current control bus, which is supplied by the generator exciter. Relay No. 16x closes, energizing control relay *CR*, which in turn energizes the coil of the generator oil circuit breaker No. 16, which thereupon closes.

The generator is now on the line without field and is acting as an induction motor.

SYNCHRONIZING GENERATORS

An A switch on No. 16 completes the circuit to hesitating control relay No. 44x. This energizes the coil of field circuit breaker No. 44, which closes, connecting the exciter to the generator field. This pulls the generator into synchronism, and it picks up load as the waterwheel gate continues to open to some predetermined gate opening controlled by means of a dial located on the governor. To the governor has been given a fairly drooping characteristic, so that the generator will not only carry approximately constant load but will do its share in holding the system to normal frequency.

It may be of interest to know that the total time taken by the automatic starting sequence from the closing of the time switch No. 1 to the point where the station is on the line, carrying full load, is approximately 35 seconds. Furthermore, the phasing of the generator is accomplished so smoothly by the automatic equipment that it is not noticeable at station No. 5 unless one happens to be looking at the line ammeters.

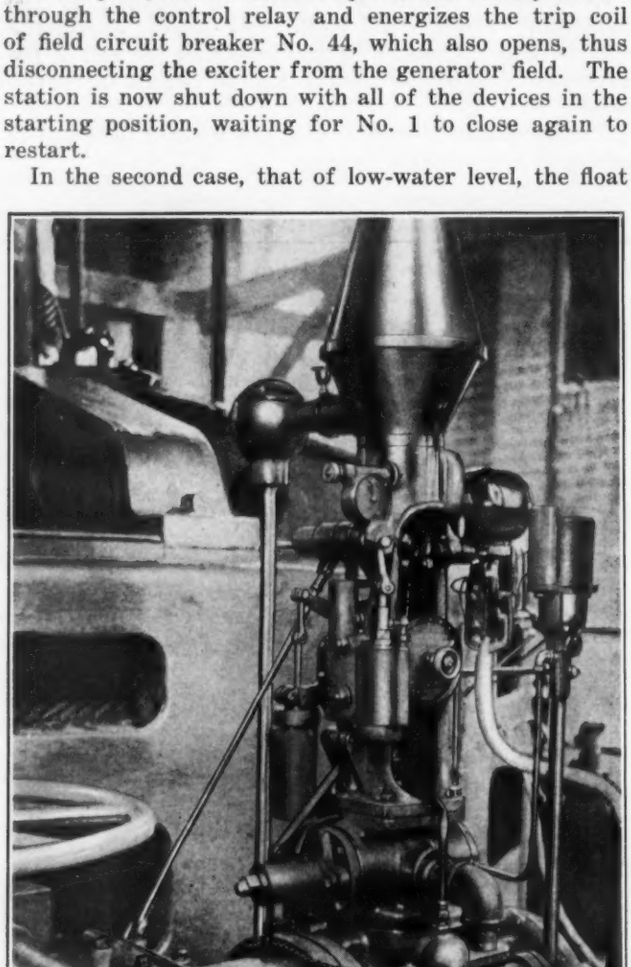
SHUTTING DOWN

Shutting down normally may be accomplished in three ways, namely, by the operation of the master element No. 1 at a predetermined time, by the operation of the float switch No. 62 when the water level falls below the predetermined minimum, and by the opening of the oil circuit breaker at station No. 5.

The sequences of operation in the various cases are as follows: When the time switch No. 1 opens its contacts, the coil circuit of No. 4 is broken and the contactor opens, de-energizing No. 65, which closes the gate. The brake-valve solenoids are also de-energized and returned to the position which allows the oil pressure to apply the brakes to the generator. Contactor No. 5 opens, and its B switch upon closing completes

the 12-volt battery circuit through a hesitating control relay. This actuates the trip coil of the generator oil circuit breaker No. 16, which thereupon opens. When No. 16 opens, its B switch completes the battery circuit through the control relay and energizes the trip coil of field circuit breaker No. 44, which also opens, thus disconnecting the exciter from the generator field. The station is now shut down with all of the devices in the starting position, waiting for No. 1 to close again to restart.

In the second case, that of low-water level, the float



GOVERNOR OF 5,000-KVA., 2,300-VOLT, THREE-PHASE, 60-CYCLE WATERWHEEL GENERATOR

switch No. 62 opens, thus opening the master control circuit and shutting down the station as described in the preceding explanation.

In the third instance, when the oil circuit breaker at station No. 5 is open, the load on the automatic station is removed and underload relay No. 37 closes its contacts. This energizes stopping relay No. 3, which, after a time delay, opens the master control circuit, shutting down the machine as above. The generator cannot start again on the operation of the time switch until the oil circuit breaker at station No. 5 is closed, thus energizing the control power transformer in the automatic station.

As to the matter of protection, every possible contingency has been foreseen and guarded against. Besides the protective features already mentioned incidental to the features of operation, there are about thirteen additional possible causes of trouble for which provision has been made. Among them are overspeed, in which case the speed-limit switch No. 12 on the generator shaft operates, breaking the circuit of No. 4 and shutting the unit down; overload or short circuit in the windings of the generator, which causes differential relays No. 28a and No. 28 to operate, tripping out generator oil circuit breaker No. 16 and field circuit breaker No. 44; underload, which actuates underload relay No. 37, energizing No. 3 and thereby opening the master control switch, which shuts down the generator. In this case, if the time switch is still in the closed position when underload conditions have ceased and the power line is still energized from station No. 5, the unit will start up again immediately.

GUARD AGAINST EVERY CONTINGENCY

Overheated bearings cause bearing temperature relay No. 38 to open its contacts at a bearing temperature of about 90 deg. C., thus shutting the unit down. On trouble of this nature the unit cannot be restarted without inspection. Low oil pressure in the governor causes oil pressure relay No. 63 to close, energizing No. 59, which breaks the coil circuit of No. 4, shutting down the machine. No. 59 must also be reset by hand before the unit can again be started.

Creeping of the wheel when the gate is closed is prevented by the operation of the gate valves as follows: When contactor No. 4 opens, it de-energizes governor solenoid No. 65 and also the relief and inlet valve solenoids. The relief valve closes immediately, but the inlet valve, which is connected mechanically to the gate, will not close until the gate is practically closed. When the gate has closed, the oil pressure in the cylinder builds up and applies the brakes, which prevents creeping of the wheel due to the small amount of water which leaks through the gates.

Delay and trouble from a serious breakdown of the directly connected exciter are taken care of by the presence of a spare exciter driven by an induction motor. In case either one fails, the other is immediately available.

The station is also equipped with a voltage regulator for regulating the station voltage. The regulator controls a short circuit around a rheostat in the field circuit of the exciter, so that if the voltage rises, the rheostat is cut into the circuit and reduces the exciter voltage and consequently the generator voltage. If the generator voltage is low, the rheostat is short-circuited, causing higher exciter voltage and consequent higher generator voltage. There is also provided with the voltage-regulating equipment an auxiliary overvoltage contactor and auxiliary exciter field rheostats.

It often happens in stations which are provided with directly connected exciters that in case of sudden loss in load on the generating equipment the speed momentarily reaches a high value, which also momentarily causes excessive exciter voltage and consequent high generator voltage. This rises to such a value that the normal voltage regulator is unable to take care of it. The above overvoltage contactor is arranged so that should this condition occur the auxiliary rheostat in the exciter field is cut in, thus dropping the exciter voltage to a point where the regulator can take care of it. Upon generator and exciter speed coming down to normal, this auxiliary field rheostat is again short-cir-

cuited by means of the contactor, and the regulator again functions as under normal conditions.

Since the station has been in automatic operation, there has been very little trouble experienced with the automatic equipment. Regular inspection of the apparatus is maintained, and care is exercised that contacts shall be kept clean. The station is in a section of the country where lightning conditions are rather severe, and the connecting high-tension line has tripped out numerous times owing to lightning disturbances. The generating equipment has in every case promptly shut down and remained down until the line was again energized from station No. 5, whereupon the equipment has promptly started up and again come on the line and carried load.

Owing to the fact that the amount of oil required for the operation of the brakes is rather large in comparison with the oil system available at the station, it was decided to operate the brakes by means of water, which is supplied at penstock pressure by means of a small valve and through proper strainers. This seems to work out very satisfactorily and results in considerable reduction in the duty imposed upon the governor oil system.

Bureau of Mines Comment on Powdered Fuel

MANUFACTURERS and operators of the larger coal-fired furnaces cannot afford to disregard the possible advantages of pulverizing their coal before burning it, John Blizard, fuel engineer of the Department of the Interior, says in Bulletin 217, just issued by the Bureau of Mines. The bulletin, which contains information regarding the preparation, transportation and combustion of powdered coal, is published through the courtesy of the Canadian Department of Mines, for which the bulletin was originally prepared. He says in part: "Since the coal has to be pulverized, it is generally better to purchase slack coal, which is usually cheaper and costs less to pulverize. The requisite composition of the coal depends upon many factors. Practically all coals from lignite to anthracite, and even coke breeze, have been pulverized and burned. But anthracite and coke breeze require more energy to pulverize them than softer coals, and low-volatile coals are difficult to ignite and must be burned in specially designed furnaces.

"One of the principal difficulties in burning powdered coal lies in the disposition of the ash, and for this reason it is desirable also to use a coal which contains little ash and that melts at a comparatively high temperature.

"The power used to pulverize and convey similar coals to the burner is approximately proportional to the weight of the coal pulverized, and it is clear that the pulverizing and conveying costs will therefore be greater per heat unit delivered the lower the calorific value of the coal.

"On the whole, powdered-coal plants cannot be said to be clean. There are fairly clean powdered-coal plants, but generally, though not universally, a plant using powdered coal is dirtier than a grate-fired plant. Powdered coal is better adapted for firing stationary water-tube boilers than other boilers. With these boilers furnaces of sufficient size and of the correct shape may be constructed, and the gases pass through no tubes wherein ash may settle to obstruct the draft and shield the heating surface.

"The possibility of a dangerous fire or explosion in a well-designed, well-managed powdered-coal plant is remote and should not influence the prospective user of powdered coal against installing it."

Arc Welding as a Manufacturing Asset

Structural Steel Can Often Be Substituted for Castings at a Material Saving — Riveting of Thin Metal Parts May Be Avoided

BY J. F. LINCOLN
Vice-President the Lincoln Electric Company

THE use of arc welding is usually limited, in the minds of the people who are not personally in touch with its application, to the repairing of broken parts or to the building up of friction surfaces that have been worn down. The average man remembers that the engines of the German ships in the harbors of the United States at the time of the late war were broken and left by the Germans as a total loss. He also remembers that by a new process of arc welding these engines were repaired in a few days and the ships put into operation, much to the chagrin of the Germans and much to the credit of arc welding. While this feat had a great effect in fixing in the minds of most people that arc welding is a wonderful thing with which to fix engines on German ships, it is doubtful if repair work is even a considerable part of its usefulness to mankind.

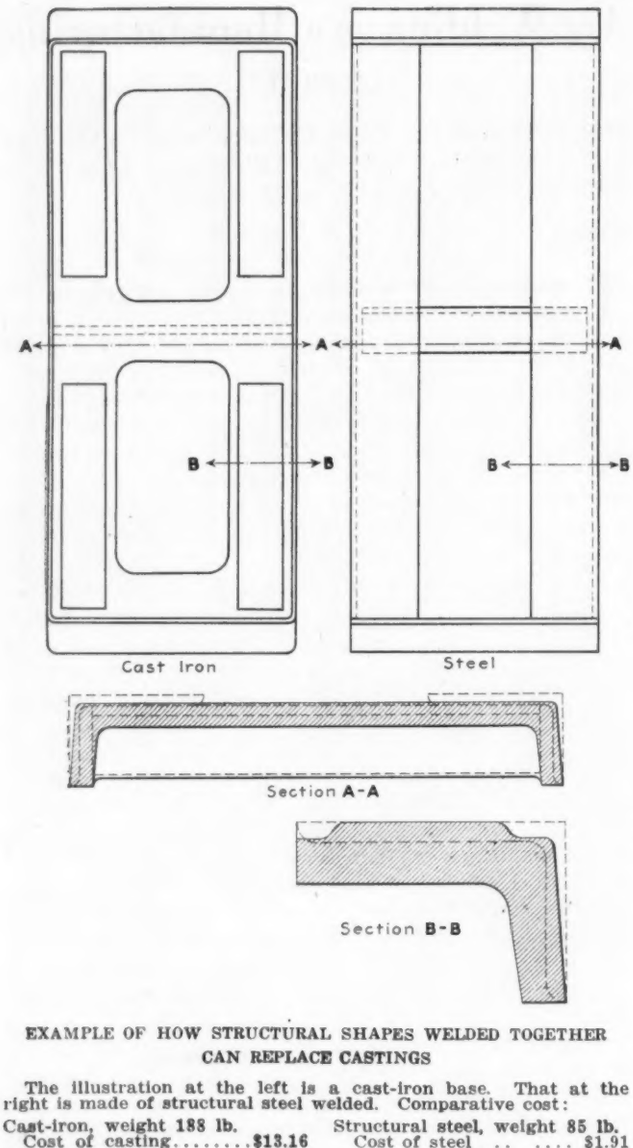
ARC WELDING A MANUFACTURING ASSET

Arc welding can be of the greatest service in the manufacture of parts which are usually made of cast iron. Its use there is not for repairing, but in the actual manufacture of these parts from standard structural steel shapes. The importance of this statement rests upon the fact that the cost of cast iron per pound compared with standard steel shapes is as three to one.

The strength of steel is as five to one compared with cast iron. This means that a part which is usually made from cast iron will if made of steel be equally strong at a cost of no more than one-fifteenth of the cost of the same piece if made of cast iron. This ratio, of course, will not always hold, because many other factors, such as appearance and inability to get the exact standard structural shape that is needed for the thing to be made, come into the problem. It does, however, show what the absolute cost ratio between the use of the two materials is when the tensile strength and cost only are considered. The cost of welding must be added to the cost indicated for steel, since the cost for cast iron on which this statement is based is for a completely molded casting, while the steel cost does not include welding. However, the welding cost is usually a small proportion of the steel cost and will vary according to the part to be made. Here lies the great opportunity of the designing engineer. He should be just as fully acquainted with the possibilities of arc welding as he is with the strength and possibilities of riveting.

The drawing shows details not because it is an extreme

case of the difference in cost between the two methods of making the same object, but because it is a part that all interested readers have seen and because the savings shown have been actually made. It is therefore a graphic illustration of what can be accomplished. The part shown is a motor-generator set base made by the two different methods. The one is a base made of structural steel parts and the other of cast iron.



EXAMPLE OF HOW STRUCTURAL SHAPES WELDED TOGETHER CAN REPLACE CASTINGS

The illustration at the left is a cast-iron base. That at the right is made of structural steel welded. Comparative cost:

Cast-iron, weight 188 lb.		Structural steel, weight 85 lb.	
Cost of casting	$13.16	Cost of steel	$1.91
Cost of machining	2.50	Cost of welding	.90
Total	$15.66	Total	$2.81

The resistance to bending is equal and the steel base is unbreakable. There is also the advantage with the steel base that no machining is necessary and the saving will more than make up for the cost of welding.

Other examples of this type that can be mentioned are:

1. Switch tanks for oil switches and compensators. Here the steel has an added advantage of being impervious to oil while cast iron is not.

2. The manufacture of motor-base rails. Here a drawn piece of channel section is made complete by welding on the tang which holds the adjusting screw.

3. The manufacture of motor and generator frames for automobile starting and lighting generators. Flat stock bent into a ring and welded will be enormously cheaper than pipe or castings such as are usually used. This also applies to frames for larger direct-current and alternating-current motors.

4. The manufacture of punch-press and drawing-press frames. Not only will the cost be not more than 10 per cent as great as for cast iron but broken frames are impossible. This would be a great boon to all users of such machines. In all these cases the saving is at least one-half of the cost of the same parts made of cast iron.

These examples can be multiplied by hundreds, and in all cases savings can be shown which range from 10 to 98 per cent of the cost of the same part made from cast iron.

CHANCE FOR INCREASED USE

When the process is fully understood by the designing engineer, he will increase again the known applications as a result of his own experience.

At present the application of the arc is made usually to parts which were designed to be riveted or brazed. This often puts arc welding at a great disadvantage as the preparation of the part is entirely different for arc welding from what it is for riveting. Even in such cases the application of the arc has made great savings.

An example that may be cited is this: The usual range boiler, made by millions and used in almost every modern home for water heating, has, by custom, been riveted ever since it was first made. Rivets on thin metal do not make a job that is tight so the tank is galvanized after riveting. The galvanizing helps to fill up the gaps left by the rivets. After a time, however, the galvanizing disappears, leaks start and a new tank is necessary. To put off the evil day of leaks the manufacturer now rivets as of old and then welds the edges down. This eliminates the leaks on the edges but does not stop the leaks around the rivets. It is a better job than before because it stops up half of the places where leaks can occur. Sometime some manufacturer will weld the seams and forget to use rivets and the problem will be solved, saving about 80 per cent of the labor cost of doing the job and producing a boiler twice as strong.

A FEW CHARACTERISTICS

The designer can rely on the following characteristics of a properly arc-welded joint:

1. One hundred per cent strength compared with the sheets welded.

2. A fraction of the cost compared with riveting, brazing or gas welding.

3. Automatic apparatus for welding duplicate work.

4. Possibilities of saving a large part of the present cost of making his product if arc welding is scientifically applied.

Arc welding in many ways is new, although the process itself is nearly as old as the discovery of the electric machine. Its progress is a revelation even to those closest to it, and new uses and methods are discovered almost daily. The engineer should look at the process as one which has wide application and one which should be first considered when the manufacture of any steel product is contemplated. Its use is tremendously more important than riveting, and its results can be almost universally depended on to be much cheaper, stronger and more satisfactory.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Dr. Hutchinson Disputes Efficiency Percentage Given for Oil-Burning Locomotive

To the Editors of the ELECTRICAL WORLD:

The report in your issue of May 5 on the discussion of A. H. Babcock's paper on "Some Fuel Determinations on the Southern Pacific System," presented at the Pittsburgh meeting of the American Institute of Electrical Engineers, seems to call for some comment, particularly with reference to the report of my discussion.

The principal object of my discussion was to point out that the interpretation given by Mr. Babcock of his own tests is misleading. His statement that the "overall efficiency" is 5.57 per cent is not borne out by the tests themselves. This efficiency was obtained by considering only the oil used when drawbar pull was positive and is measured at the rim of the drivers, i.e., includes the work done in moving the locomotive itself.

My viewpoint is that this is entirely misleading—that all oil used should be included, and that efficiency should be measured at the drawbar for the same trailing load. Under these conditions the efficiency becomes 3.12 per cent—very different from 5.57 per cent. This, the most significant point of my discussion, is not referred to in your report, which, in effect, spreads abroad the statement that the efficiency found was 5.57 per cent.

It would have been interesting to discuss the general matter of railroad electrification as Mr. Davis seems to have done, but Mr. Babcock's paper did not touch upon this in any way, and I therefore confined myself to the subject of the paper.

CARY T. HUTCHINSON.

New York, N. Y.

Reactive Kva., Prunes and Poems

To the Editors of the ELECTRICAL WORLD:

In regard to R. C. Fryer's letter in the ELECTRICAL WORLD for April 28 concerning the justice of billing power consumers for reactive kva. or reactive kva.-hours, I am inclined to agree with Mr. Fryer that it would be difficult to justify any rate applied to something delivered and returned 120 times per second, and which neither the central station nor the customer wants or can use.

If a grocer sells and delivers to a customer a pound of prunes, he should be entitled to the cost of the prunes delivered through his regular channels. If the customer orders the prunes sent up accompanied by an original poem on prunes, it is quite likely that the grocer would expect the customer to pay for the poem.

Reactive kva.-hours are fully as harmonious and beautiful as a poem, of a little less economic value, and their cost of production and delivery is indeterminate. They resemble the active kva.-hours very much as the poem resembles the prunes. On the other hand, it is true that in many localities cost of electric service is practically independent of the amount of energy used but is almost wholly dependent on demand, not in kw. but in kva. These considerations lead one to preserve a mind open to reason and conviction and to hesitate before condemning categorically the idea of charging for prunes on a conversion ratio of liters to poetic meters, or for electric service on a basis of reactive kva. In the early days central stations charged on the basis of lamps; later the charge was for ampere-hours. Here in Connecticut at the present time electric service is paid for on the basis of the number of square feet floor area, and consumers appear to be happy about it; moreover, in the main it is equitable.

Information on all points controlling the cost of electric service should be secured by the central-station company, and this includes, among other things, energy consumption and power factor. At least two instruments are necessary to obtain this information, and if active and reactive component watt-hour meters are used, other information may be derived, including kva.-hours. Local conditions will determine the most convenient and most equitable measurements to use.

H. J. BLAKESLEE,
Treasurer.

The States Company,
Hartford, Conn.

The Central Station and Street Lighting

To the Editors of the ELECTRICAL WORLD:

The ELECTRICAL WORLD in its campaign for better street lighting is rendering a service to the industry worthy of the highest commendation. The editorial in the issue of Feb. 24 on "How a City Gains by Better Street Lighting" sums up the whole situation in a nutshell, and the last paragraph, "What does the operating company gain?" is of vital interest to the electric light and power companies.

Many of the operating companies have apparently failed to recognize that the rapid development in street-lighting practice during the past few years has created new conditions and that, in the interest of the industry, the central-station companies must take their place in their respective territories as leaders in the promotion of improved street lighting.

While it is true that, in spite of large advances in the cost of materials and labor, street-lighting rates have remained practically constant and that the street-lighting load has not generally been an attractive one for the central stations, there is no reason why the central stations should not undertake the sale of better street lighting on a business basis, charging a rate which would make it a profitable part of their service, interesting to the city as an economical improvement contributing to its safety and progress. Street lighting should not be looked upon as a political football, threatening municipal ownership. It is a civic improvement, affording the central station an opportunity for meeting municipal officials on a common ground, and should be the means of developing cordial relations between the central stations and the municipality.

The manufacturers of street-lighting equipment are doing their part in educating the public by extensive national advertising campaigns and by missionary work through trained street-lighting experts. Municipal officials are also showing their interest by giving a prominent place to discussions on street lighting at meetings of municipal associations and societies.

The real development in the street-lighting business will only come when the central stations themselves advocate improvements instead of holding aloof and awaiting the results of the efforts of the manufacturers of lighting equipment. If the municipal demand and the central-station ability can be co-ordinated, there is before us a tremendous prospect for more and better street lighting.

L. A. S. WOOD.
Manager Illuminating Section.

Westinghouse Electric & Manufacturing Company,
South Bend, Ind.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of
Generation and Distribution Equipment, and Methods of Economically Utilizing
Electric Service in Large Industrial Plants

Automatic Switch-Reclosing Apparatus

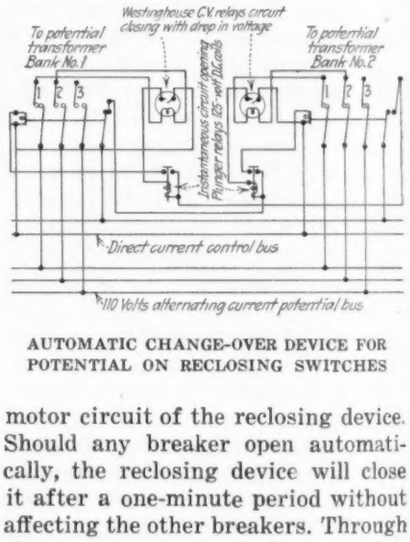
Developed by Alabama Power Company and Successfully Used in Several of Its Substations—Has Extensive Application to All Classes of Apparatus

FOR the automatic reclosing of switches which are opened because of trouble on the circuit or in apparatus connected thereto the Alabama Power Company has developed the apparatus described and illustrated herewith. At the Vida substation this reclosing equipment has been successfully used for more than a year to operate a 44,000-volt, 300-amp. G. E. "KO-26" oil switch. This station is operated by one man whose additional duties involve two days per week spent in patrol of lines in the district. The switch operated by the reclosing device controls an important circuit supplying Selma and other large customers. Continuity of service is of the utmost importance, and if during lightning storms, when the operator may be out on patrol or away from the station getting supplies, or during the night, when he may be asleep, the switch opens automatically because of flashovers or other troubles on the line, the reclosing device will, after a period of one minute, reclose the line switch. If trouble still exists, the switch will immediately open automatically the second time and close once more after a period of one minute. A continued fault will cause the switch to open again automatically, after which it will become inoperative until reset at some time by the operator after the trouble has been cleared.

The energy for operating the reclosing device may be either direct-current or alternating-current, and only 300 watts at the maximum is required. At Vida the source of supply is secured from a 44,000-volt potential transformer used to carry a few lamps about the station.

During the lightning season of last year the oil breaker at Vida automatically opened a number of times, and in each instance the reclosing device closed the breaker after the one-minute period. Recently line failures caused short circuits which remained until troubles were cleared on patrol, and the device reclosed the oil breaker twice and then became inoperative until the line foreman telephoned the Vida operator to test the circuit.

At the Dora substation four 2,300-volt feeder switches are connected for operation from a single reclosing device. Each switch has an individual contact switch closing the

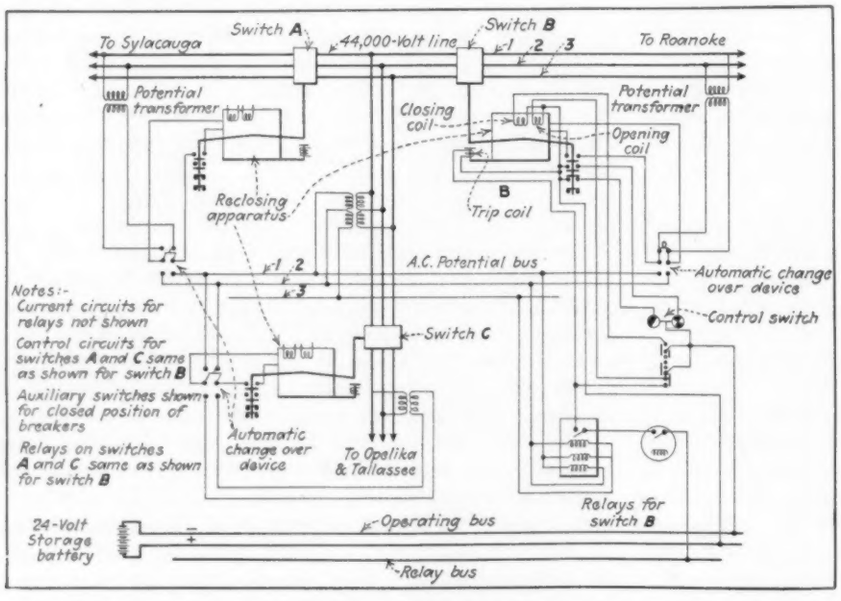

To potential transformer Bank No.1
Westinghouse C.V. relays circuit closing with drop in voltage
To potential transformer Bank No.2
Instantaneous circuit opening Plunger relays 125-volt D.C. coils
Direct current control bus
110 Volts alternating current potential bus

AUTOMATIC CHANGE-OVER DEVICE FOR POTENTIAL ON RECLOSING SWITCHES

motor circuit of the reclosing device. Should any breaker open automatically, the reclosing device will close it after a one-minute period without affecting the other breakers. Through this arrangement each feeder switch becomes automatically operated practically as though controlled by a separate reclosing device, thus reducing considerably the first cost.

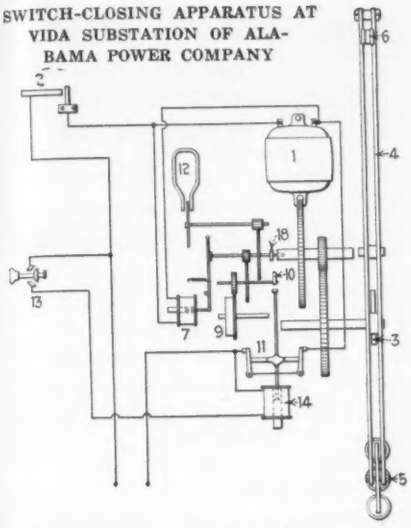
More recently the reclosing equipment provided with trip free attachment, trip coils and opening coils has been installed at Opelika substation, making this station almost fully automatic. The wiring of the control circuits is shown in one of the accompanying diagrams. The reclosing equipment on switches *A* and *B* takes its potentials from potential transformers on the respective lines. Switch *C* gets its potential from a contactor (shown in detail) which automatically makes connection to the transformer which is energized.

On the reclosing device furnished for the Opelika substation the trip free attachment is a set of auxiliary levers working in between levers (4) on the schematic diagram of the reclosing equipment and arranged with latches and trip coil so that these



OPELIKA SUBSTATION MADE PRACTICALLY AUTOMATIC BY SWITCH RECLOSING DEVICE (AUTOMATIC CHANGE-OVER SWITCH SHOWN ABOVE)

SWITCH-CLOSING APPARATUS AT VIDA SUBSTATION OF ALABAMA POWER COMPANY

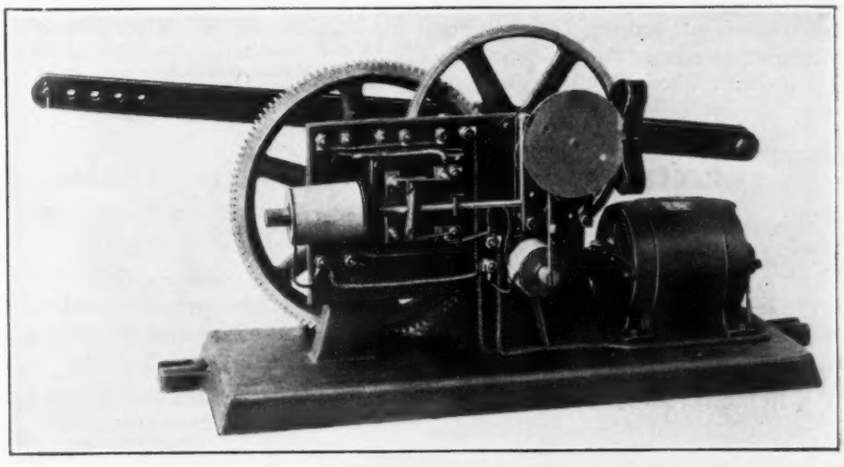


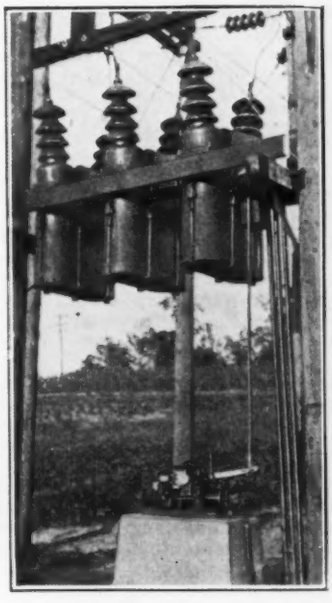
The small motor (1) for driving the gear train is designed for alternating current at 110 volts. The auxiliary switch (2) is so mounted on the oil breaker that when its blades are opened the contacts (2) are closed, thus establishing a current supply through cut-out switch (11) to the motor. The cam (3) attached to the main shaft of the large gear in revolving moves the lever (4) in such a way as to put the springs (5) under tension. When the rod (6) has reached the lowest point in its travel the mechanism of the switch to which the reclosing device is attached latches to close its contact when operating handle is moved in the opposite direction. As the cam (3) revolves further the tension of the springs is released for returning the lever (4) to its original position, thus closing the switch. When the circuit is closed through motor, potential across its terminals is applied directly to the clutch magnet (7) and the clutch (8) is made to engage with the revolving shaft. Movement of the gear train controlled through the clutch (8) winds up the spring on the larger gear (9). As the gear train continues to move the lever (10) revolves into contact with push rod controlling the cut-out switch (11) and finally the switch is opened, thus disconnecting the current supply to the motor (1) and stopping the operation of the device. The stop under lever (10) may be adjusted so that the motor is shut off when the cam revolves for closing switch once, twice, thrice or any predetermined number of times. As soon as the cut-out switch (11) opens the potential is removed from the clutch magnet and the clutch (8) disconnects the reset mechanism from the shaft. The spring (9) unwinds, reversing the movement of the gears, and returns the reset mechanism to its original position for another cycle of operation. The magnet and disk (12) retard rapidity of motion as gear train is reversing to original position after operation of device. Assuming stop is set under lever (10) for a cycle of two switch operations, then when closing contacts (2) are closed cam will close switch, say, after an interval of one minute. Trouble still being upon the circuit, the switch automatically reopens instantly, and then current supplied through contacts (2) is continued to motor until second closing operation, at which time the lever (10) operates cut-out switch and the device becomes inoperative until pull button (13) on switchboard is made to energize the reset solenoid (14) for reclosing the cut-out switch (11).

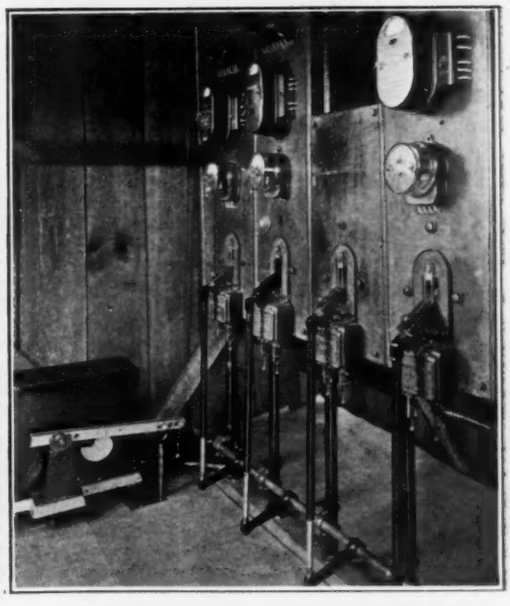
features become a part of the device instead of the oil switch itself. In other words, energizing the trip coils releases the auxiliary levers which are connected to the main breaker and permits the breaker to drop open. The reclosing device is immediately set into motion and the cam operates to lift the levers (4) to relatch the auxiliary levers at the upper end of the stroke and to bring both the auxiliary levers and levers (4) down together as the roller travels along the vertical face of the cam for closing the switch. The opening coil is attached to the present reset solenoid or closing coil and makes it possible to remotely control the opening of the cutout switch (11). This attachment eliminates the use of the Westinghouse KN-relay. Westinghouse control switch No. 271787 is easily applied for control of the device.

Reverse power relays on switches *A* and *B* and overload relays on switch *C* provide the necessary protection. The potentials for the reverse-power relays are taken from the potential transformers which actuate the reclosing devices. Phases 1 and 3 are wired through auxiliary contacts on switches *B* and *A* respectively, so that in case either incoming line is out of service for repair or maintenance work there will be no danger of a feed back from the "live" line.

In case of trouble on the Sylacauga line, switch *A* will open automatically and will reclose as soon as the line is energized from Sylacauga. If the potential coil for switch *C* is connected to the potential transformer on this line, it will automatically be switched over to the potential transformer on the Roanoke line by the device mentioned above, thus keeping the reclosing device on switch *C* operative. If the trouble occurs on the Roanoke line, the reverse operation takes place. In case of trouble on the Opelika feeder the device on switch *C* will operate to restore service. When trouble occurs on the two incoming lines and the Opelika feeder all three switches will open automatically. The switch on the incoming line which is first energized will close, and a fraction of a second later switch *C* will close and restore service to Opelika.







ALABAMA POWER COMPANY SUCCESSFULLY DEMONSTRATES THE USE OF RECLOSING SWITCHES

Top—Reclosing device that is shown elsewhere schematically. Left—44,000-volt, 300-amp. G. E. KO-26 oil switch operated for over a year with automatic device. Right—Four 2,300-volt feeder switches at Dora, operated by single reclosing device.

As soon as one incoming line switch has opened and remained so the reverse-power relay on the other incoming line is inoperative since the potential circuit has been opened as explained above. This will not matter, however, as switch *C* still has overload protection which will take care of trouble on the Opelika feeder, and in case of trouble on the incoming line service will be interrupted to Opelika anyway, so that automatic operation of either incoming line switch is not necessary when the other one is open.

It will be noted that the automatic devices are connected to the pull-button control switch, in such a manner that they can be operated from the board like regular electrically operated breakers.

This reclosing device, which is now being manufactured by the Southern States Equipment Company, has extensive application to all clases of automatic switching apparatus erected at isolated stations with or without regular attendance and where there are no large storage batteries installed or the available alternating-current capacity for operating such a device may be small. Should expense for the purchase of potential transformers to furnish alternating-current supply become prohibitive, the device may be altered to operate from the type of storage battery commonly used in automobiles. Typical installations include switches, controlling feeders at mines where overloads are frequent and attendance irregular, isolated substations on transmission lines supplying small distribution systems and feeder substations of a control-station system where automatic operation serves materially to reduce yearly costs. The simplicity of the apparatus makes for low manufacturing costs and minimum maintenance expenditures with very little attention except occasional oiling and inspection.

G. H. MIDDLEMISS,
Superintendent of Distribution.
Alabama Power Company,
Birmingham, Ala.

Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

Instructions for Operating Feed-Water Heaters

ACCORDING to the operating code of the Philadelphia Electric Company, the three principal reasons for heating feed water are: (1) To utilize the heat of exhaust steam which would otherwise be wasted. One per cent of over-all efficiency is gained per 10 deg. F. increase in temperature of the feed water. (2) To prevent excessive stresses in the boiler caused by cold water striking heated surfaces. (3) Because dissolved air in the feed water is driven off by heating to 212 deg. F., and this decreases the amount of corrosion in the boiler and economizer.

In filling feed-water heaters, exhaust steam must be admitted slowly at first, to allow the water to heat uniformly, otherwise unequal expansion strains would be set up. The discharge valve is opened slowly to prevent the cool water of the incoming heater from reducing the temperature of the feed water from other heaters then in use. Vents on the heater must be kept open in order to allow air to escape which has been liberated by heating the water. The above code gives the following instructions for putting a heater on the line and for taking it off:

PUTTING A HEATER ON THE LINE

1. See that the drains are closed.
2. See that the vents on the heater are open and remain open.
3. See that the gage glasses are open and in operation.
4. See that the water valve on the seal is open and fill the seal, then cut down the water supply to a small amount.
5. Open the water-inlet valve and exhaust-steam valve slowly.
6. See that the float valves are operating freely.
7. When the heater has reached the operating level, partly open the discharge valve to the boiler-feed-pump suction line.
8. Open the exhaust-steam valve wide. When the operating temperature is reached, open the water-inlet and discharge valves wide.
9. See that the proper amount of pressure is obtained in the exhaust-steam header.
10. Open any trap discharge lines that lead to the heater.
11. See that the valve on the connection between the heater and float tank of the weir recording apparatus is open.
12. See that heaters divide the load equally and that the meter mechanism is operating properly.

TAKING A HEATER OFF THE LINE

1. Partly close the water-feed valve and allow the water to reach minimum level.
2. Close the exhaust valve.
3. Shut off all traps entering the heaters.
4. Close the feed-water valve.
5. Close the discharge valve to the pump suction line.
6. See that the vents are open.
7. Open the drain.
8. Before opening the heaters, close the vents.

Using Induction Motor to Start Frequency Changer

IN ORDER to raise the rotor of frequency changers from the bearings by a film of oil, thereby requiring a much smaller starting motor than would be needed were the rotor not lifted, oil is supplied to the bearings under pressure. The following instructions for starting frequency changers with an induction motor and for shutting them down have been abstracted from the operating code of the Philadelphia Electric Company:

STARTING

1. When an oil pump is supplied, start it.
2. When the oil pressure reaches the proper value, open the valves admitting oil to bearings.
3. Adjust the valves on the pipes feeding the bearings so that the one farthest from the pump will be opened widest. If this does not lift the shaft from the bearing, open one valve at a time wide until the shaft does lift. Then adjust the valves as stated above.
4. See that the controller is in the starting, or "off," position.
5. Close the switch of the starting motor, observing the ammeter.
6. When the starting motor current falls to a specified value, cut in the next step of the controller, again allowing the current to fall in the specified value. Repeat until the proper controller point for synchronizing is reached. This point should be marked on the controller.
7. Shut down the oil pump.
8. Put on the fields of 60-cycle and 25-cycle machines and raise the voltage of the machine to be synchronized first to that of its bus.
9. When one or more sets are already in operation, plug in the synchronoscopes of both machines and bring the incoming set to approximately synchronous speed by varying the field of the machine to be synchronized last. When pointers of the synchronoscopes are in proper position with respect to each other (determined by a synchronizing calculator) close the oil switch of the machine to be synchronized first, when it is in synchronism.
10. Open the switch of the starting motor, place the controller in the "off" position, adjust the voltage of the machine to be synchronized last, and close its oil switch.

SHUTTING DOWN

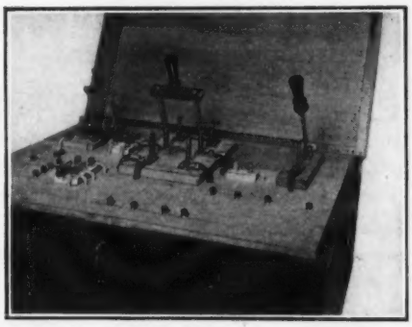
1. Adjust the power factor of the machine to be taken off first (either 25-cycle or 60-cycle) to unity.
2. Open oil switch of that machine.
3. Adjust the power factor of the other machine to unity and open its oil switch.
4. Cut in all resistance of both field rheostats.
5. Open the field switches.

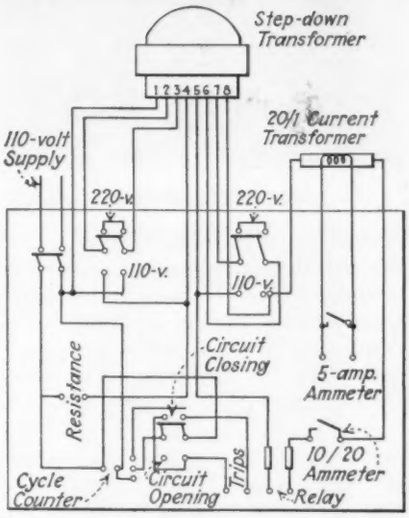
Portable Set for Testing Relays

IN TESTING induction-type relays during the past it has been the practice of the Alabama Power Company to base all settings on a test curve showing relay characteristics when the 4-amp. tap is being used. This was done because it was impossible to pass more than 22 amp. through the relays with the portable test sets then available. It was found, however, that a test curve based on the higher-current taps would not pass through the same points as one based on the 4-amp. tap. A difference of 2 cycles to 10 cycles was observed between 150 and 400 per cent current setting.

Consequently the relay-testing set shown in the accompanying illustration was developed and is now being used in each station. All of the test equipment except the cycle counter, ammeter and adjustable resistor are contained in the test set. The test man carries these and also leads, contact parts, air valves for relays, oil and a folder containing curves and data on all relays on the system. The resistor is a Ward Leonard loading rheostat similar to the "RLR-120" except that it has a capacity of 10 amp. in steps of 0.1 amp.

A step-down transformer is used with the set to make it possible to obtain large current at low voltage without overloading the 110-volt supply. The windings of the primary and secondary may respectively be connected in series or parallel by means of the double-throw switches on the test set. This provision, together with the lower right-hand knife switch which cuts out a high reading ammeter when current values are such as to require the use of the current transformer shown above, enables the operator to obtain practically any current required for testing relays.





FIGS. 1 AND 2—EXTERIOR AND WIRING CONNECTIONS OF RELAY TEST SET

The coil and contact of the relay to be tested are connected across the four terminals at the bottom of the winding diagram. If the relay is of the circuit-closing type, the double-throw switch to the left is placed in the upper position. If the relay is of the circuit-opening type, the double-throw switch is placed in the lower position.

The resistance mentioned above is a variable resistance used to regulate the current in the step down transformer primary.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Indoor Breakers Converted to Outdoor in Need

BEING faced in an emergency with the immediate need for outdoor circuit breakers and having nothing but indoor units which had the desired rating, the one Southeastern power company undertook to convert these units for outdoor service. The chief changes required were to substitute outdoor bushings for the existing ones and to pro-

SYSTEM RELAY RECORD AS OF JANUARY 1, 1922.
ANNISTON.

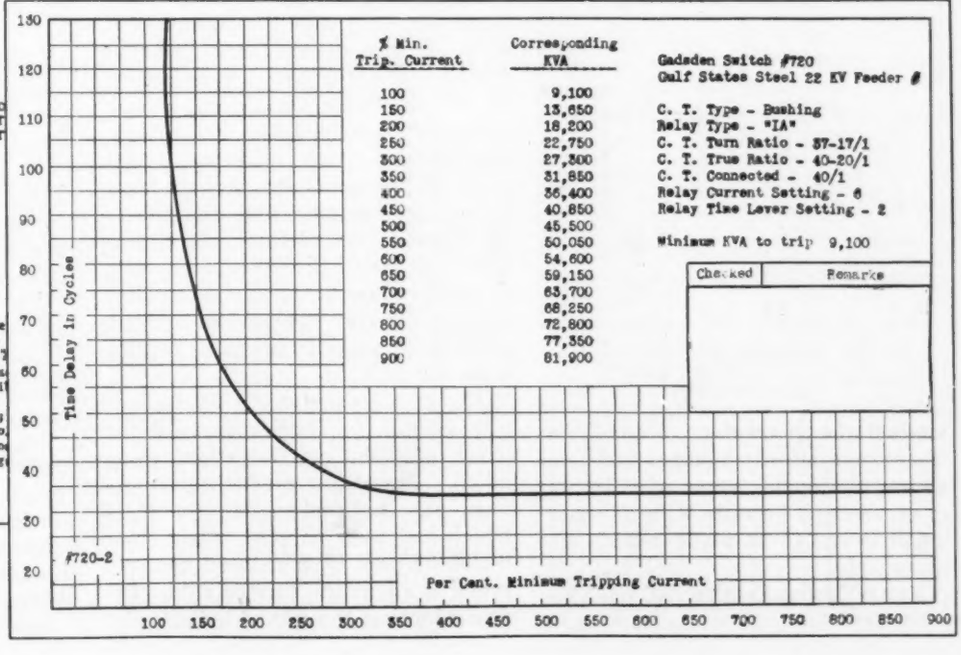
		Type-	Turns-	True-	Con.	Type of Relay	Minimum trip values KVA	Line A	Relay A	150 Percent Load KVA	Line A	Relay A	Time	Checked.
604	L.T.#2 Bank B		75/36/1	80/40/1	40/1	1K4	9150	120	3	13700	160	4.5	Inst.	(4-29-21) 10-7 Jones & Stewart
606	L.T.#1 " B'		75/36/1	80/40/1	40/1	P.Inst. 1K4	9150	120	3	13700	160	4.5	Inst.	10-17-22 Jones & Stewart
604	L.T.#2 Bank B		75/36/1	80/40/1	40/1	P.Inst.								
606	L.T.#1 Bank B		75/36/1	80/40/1	40/1									
650	L.T.1200 KVA Bank A				160/1	160/1								
1804	Old Furnace Substation	B	55		60/160/1	T								
7	Kilby 4000 volt Feeder	A			60/1	60/1								
8	Lynchburg 4000 Feeder	A			50/1	50/1								
9	Foundry 4000 volt Feeder	A			12/1	12/1								

Note: Switch 604 - one se
" 606 - ditto

ABBREVIATIONS: Current transformer type T
Turn Ratio - number of s
True Ratio - actual rati circuit.
Relays: "P" Plunger Type; "IK-4" - G. E. Co. "Inst." Instantan
Relay Time settings are g

Nov. 23,1922

FIGS. 3 AND 4 — CURVES AND DATA OF THIS KIND FOR EVERY RELAY ON THE ALABAMA SYSTEM ARE CARRIED BY EACH TEST MAN



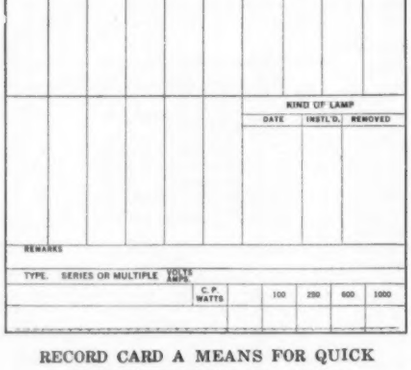
vide a weatherproof housing for the operating mechanism.

Consequently the old terminals were removed and outdoor bushings substituted without any change except to provide cork gaskets. Then a housing for the operating mechanism was improvised. This was done by bending angle irons, which were to serve as the attachment of the housing to the circuit-breaker cover, to conform to the contour of the breaker cover. Cork gaskets were then placed under the angle irons and drilled to receive cap screws in the breaker cover. At the corners the angle irons were welded together. The lower part of the housing (in two parts), which was made of ⅛-in. sheet metal, was riveted to the angle irons, while the top, made of thinner metal, was fastened to the lower part with wing nuts.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Keeping Street-Lighting Records

A CARD-INDEX file system has been found very satisfactory by the Detroit Edison Company for keeping records on street lamps. The 5-in. x 5-in. card shown in the accompanying illustration is used. It contains information showing the individual number of each lamp, the location of the lamp and the type of fixture in which the lamp is used, and it affords means for recording burn-outs and broken globes, so that the life of each lamp can be checked


Form 641-C STREET LAMP RECORD CARD

LAMP RENEWED | GLOBE RENEWED | POST RENEWED

KIND OF LAMP

DATE | INSTL'D. | REMOVED

REMARKS

TYPE. SERIES OR MULTIPLE VOLTS AMPS C.P. WATTS 100 250 600 1000

RECORD CARD A MEANS FOR QUICK RECAPITULATION OF LAMPS AND FIXTURES

against the guarantee. In addition, the system affords a means for quick recapitulation of lamps and fixtures in service and permits billing against small towns to be made readily and accurately.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

Industrial Trucks Effect Striking Economies

EACH industrial electric truck in a group located at Balboa, Canal Zone, replaces six laborers at $45.76 per month each, or $274.56 per truck, besides saving about 60 per

BULK LOADS CONVENIENTLY HANDLED

cent of the time formerly required in the handling of material, according to advices received from an operating chief at the Pacific terminal. The service performed consists principally in transferring incoming freight from cars to temporary and permanent storage sites and delivering supplies to steamships berthed at the various docks. An installation of Yale industrial trucks at this terminal is operated at an average monthly expenditure of $185.76 each, which includes the operator's wages, upkeep, depreciation and energy consumed in charging.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Boiler Paint Stops Corrosion of Turbine Disks

INTERNAL boiler paint has been successfully used for many years to prevent corrosion and adhesion of scale on internal surfaces of boiler drums. About a year ago engineers of the Southern California Edison Company conceived the idea of experimenting with internal boiler paint to prevent the trouble they were experiencing from corrosion of the wheel disks of their steam turbines. Some of the wheel disks of a 20,000-kw. vertical Curtis turbine were thoroughly cleaned and painted, while other disks in the same turbine were not painted.

About a year later this turbine was opened for inspection and the effect of painting the wheel disks noted. Practically no further corrosion was noticeable on the disks which had been painted, while those which had not been painted had corroded at about the former rate. Before adopting the use of boiler paint to prevent disk corrosion the depreciation of turbine-wheel disks due to corrosion was about $250 per disk per year.

J. W. ANDREE,
Engineer, Operating Department.
Southern California Edison Company,
Los Angeles, Cal.

Cost of Building 3,000-Kva. Transformer Substation

THE accompanying itemized costs of a 3,000-kva. substation, exclusive of land, have recently become available in connection with a Massachusetts substation extension begun in 1917 and completed in 1919. Three 1,000-kva., 22,000/2,300-volt units were installed with complete substation equipment as listed.

SUBSTATION INSTALLED AT A COST OF $8.56 PER KVA.

Three 1,000-kva. transformers	$9,103
100 lb. blotting paper for oil filtration	22
Two L-3V floodlighting units	88
One 22,000-volt lightning arrester	745
One No. 102,879 relay	15
Six L-224,644 overload relays	127
Two PP-St. circuit-breakers complete	2,529
Fifteen three-unit stud anchorages	7
Three 300-amp. air-break disconnecting switches	484
Two S-224,644 overload relays	44
Two oil switches complete	867
One tank-lifting device	35
One panel and fittings (1779, SOCR)	32
One storage battery complete	946
One motor generator, 2.2 kw.	221
One battery panel with instruments	264
1,282 lb. electrolyte	33
250 ft. 1¼-in. galvaduct	52
75 ft. 1-in. Sheraduct	13
80 ft. ⅜-in. Sheraduct	7
Two steel cabinets	10
Condulets and covers	89
Miscellaneous	1,145
Two 2,200-volt potential transformers	40
Two 1,000-amp. current transformers	74
One 5/1,000-amp. type H-2 ammeter	27
One 1,000/5-amp. 220/100-volt wattmeter	22
One 5-amp., 110-volt, 4,000-kw. wattmeter	56
One 175-volt voltmeter	34
800-ft. fiber conduit	52
275 3½-in. couplings	26
26 3½-in. 90 deg. conduit bends	52
54 2½-in. Sheraduct bends	26
280 ft. 1,000,000-circ.mil lead cable, 5,000 volts w.p.	588
200 ft. 1,000,000-circ.mil single conductor cable	330
357 lb. ½-in. copper tubing	171
194 lb. 1-in. copper tubing	95
200 ft. ⅛ in. x 2-in. bar	137
Three type MS 220-volt, three-conductor potheads	87
Seven type TS 2,300-volt one-conductor potheads	90
275 ft. No. 6 twin lead-covered wire	66
280 ft. 124-conductor lead-covered cable	80
282 ft. 123-conductor lead-covered cable	72
100 ft. four-conductor stranded copper cable	10
230 ft. three-conductor stranded copper cable	18
100 ft. 1-in. galvaduct copper cable	16
255 ft. solid "Sicimore" wire	3
160 ft. No. 6 stranded double-braided rubber-covered wire	9
250 ft. No. 10 stranded double-braided rubber-covered wire	7
255 ft. No. 12 solid wire	9
200 ft. ½-in. galvaduct	16
100 ft. No. 10 twin rubber-covered wire	5
Insulators, fittings, clamps	504
Labor	3,762
Labor and material on vault in basement	633
Insurance	74
Engineering	1,620
Total	$25,698
Cost per kva.	$8.56

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

A Merchandise Sales Code

Fundamental Principles Which Should Be Observed by the Central Station Commercial Department in Selling Appliances

By W. E. Clement
Commercial Manager New Orleans Public Service Inc.
General Chairman Sectional Joint Committee for Business Development of the Southwestern Geographic Division, N. E. L. A.

IN GOING after new business the commercial manager of a central-station company should do so with a broad understanding of what will be profitable to the company as a whole—not merely what will make a good showing from a spectacular viewpoint. This is particularly true in the sale of appliances where the objective is twofold—first, to build up the connected load, and, second, to conduct this branch of the business so that it will at least be self-sustaining and preferably show an actual net profit. Though there is always a certain amount of this business which comes in of its own volition, it is only by carefully working out and following a definite plan that it can be made to produce a maximum volume of business and earn a profit.

W. E. CLEMENT

It sometimes happens that the sale of merchandise fails to pay its way not because of a lack of volume but because some of the cardinal principles of any successful retail business have been overlooked. Central-station merchandising does not differ greatly from other businesses, but there are certain broad principles which should be carefully adhered to if the department is to be successful and stand upon its own feet. Merchandise sales operations may be classed under six general headings — buying, stock keeping, sales floor and window displays, sales policy, sales advertising and the sales force. The organization and handling of these fundamental features may advantageously be carried out as follows:

Buying.—Buy the best appliances made. Stick to one manufacturer's complete line when all items are as good or better than similar items of any other line. Purchase so as to secure quantity discount, but bear in mind that slight differences in discounts are not usually a saving unless the additional merchandise can be moved quickly.

Always have at hand up-to-date stock sheets from your manufacturers and jobbers on all fast-moving merchandise, and know the time required to place this merchandise in your storeroom.

Grant all salesmen an interview. Let them wait for you, but make them comfortable while waiting. Don't let them waste their time or yours, but let them know that you also sell things, and that you like to make it easy for them to sell to you when possible. Not many new good things are missed if you are easy to approach.

Stock Keeping.—There should be no uncertainty or leaving to chance as regards the proper and accurate receiving, checking, pricing and storing of merchandise. A few months of uncertainty or carelessness may take high-priced help hours to straighten out. If $100 in currency is being received, it is accurately accounted for. If merchandise is being received for which $100 is to be paid, should it be any less accurately accounted and less properly cared for?

Sales Floor and Window Displays.—Equip your sales floor and windows with modern but not necessarily expensive store and window fixtures, including the best and most correct lighting installation in town. Arrange your merchandise so that a customer can locate without effort the kind of appliance she may be in search of and, at the same time, be aware of seeing distinctly several other kinds of appliances that she may not possess.

On the sales floor make groups of the different types and sizes of the same kind of appliances. As a rule, display one article only of each of the items of your complete line. Sell the articles on display. A shop-worn article should be offered at a big reduction in price to force a quick sale. These methods help to keep your merchandise appearing fresh and new.

The show windows are so valuable a sales medium that a special study of window trimming is necessary in order to get the return from them that you are justly entitled to expect. It is not necessary to mention that sales floors and windows can never be kept too clean and neat.

Sales Policy. — Form your sales policy from a definite knowledge of such important factors as the possibilities and limitations of the field you expect to cover and the amount of money that can be invested in stock and time-payment accounts. Consider the relation of short and long-time payments to gross sales; consider the manufacturer's guarantee on the merchandise to be handled; consider what arrangements are to be made with other departments of the utility, so that a merchandise sale may be handled as any other efficient retail store would handle a similar sale; consider whether it is intended to promote intensely, and perhaps at a loss, any or

all new but practical appliances; consider what percentage, if any, of net profits on merchandise sales as a whole is to be sacrificed for rapid increases in kilowatt-hour sales; consider the number and kind of campaigns to be run yearly; consider the relations you expect to maintain with the contractor-dealers, and consider the experience and ability of each individual in the sales force. After weighing such factors as these you are in a position to form a sales policy which will be in keeping with the sales service you expect to render.

Sales Advertising.—Consider carefully all possible advertising mediums and their relative value to you. Make use of, but not abuse of, all free advertising matter supplied by manufacturers—such as stickers for bills, descriptive pamphlets, counter stands, window cards, price tags, etc. Estimate the amount to be spent with each of such paid advertising mediums as you expect to use. Time all advertising so that you are featuring the merchandise your sales force is focusing on. Unusual methods and special attention are necessary when conducting a campaign. Adopt the slogan, "Tell it to them quickly, and tell it to them often." Housewives are the biggest and best buyers of electrical merchandise. They have been educated to certain styles of advertising—direct your advertising to them along the same general lines that the big successful retailers use. Study advertising. The biggest and most successful merchandisers personally direct their advertising.

Sales Force.—The sales manager must have first a thorough knowledge of the inside workings of a utility and the service it is expected to render. Next, he must understand merchandising as well as, and preferably better than, the average successful retailer. A low-priced man, if he really is a low-priced man, will not do, as the entire standard of the utility will be lowered and the investment will prove expensive.

A sales manager of ability should receive broad authority and be subjected only to the advice and regulation of the general manager or, in large holding companies, to the instructions of a sales manager in charge of all sales operations for the holding company. Selection of this man is vital to the promotion and best interests of the utility, including the profitable handling of merchandise.

Merchandise salesmen should be carefully selected, especially considering their natural or acquired ability to meet and please the public and to work without friction with their business associates.

Morning Meetings Essential

The sales manager, when possible, and his assistant at all other times, should conduct a morning meeting, starting at a fixed time and ending ordinarily at a fixed time. This brings the sales manager in personal contact with his force and gives him an opportunity to issue instructions and discuss sales problems.

Merchandise salesmen may be assigned to sections of the territory served and maintain a perpetual canvass and "follow-up" of each user of electric service in this section, using any good method for keeping up-to-date records of this work. When organizing a campaign these records are of great value.

The territory salesmen will probably get the best results if paid a nominal salary plus a liberal commission, provided that a careful survey has been made of the possibilities for sales and that the man of average ability is then allowed to make the average income for similar work. This method weeds out the inefficient man and properly compensates the man of exceptional ability. A daily report of the sales of each individual salesman and a comparison of these reports establish a healthy condition of friendly competition in the department.

There should be constant help and training given the salesmen. Each individual should understand thoroughly the company's service and the merchandise he sells. Manufacturers' and jobbers' representatives can frequently be used as an aid to the instruction and training of salesmen.

As the sales force comes in daily contact with a great many of the company's customers who judge the utility by the promptness, courtesy and ability of these men, too much attention cannot be given to developing a truly representative organization of salesmen.

Boston Electrical Home Opened

UNDER the auspices of the Boston Electric League, an electrical home was opened to the public on April 14 in the Wauwinet section of West Newton. Devices to be shown were selected by drawing lots, and the trademarks and makers' names were concealed in order to avoid any bias on the part of the visitor toward any particular type of equipment shown.

All branches of the local electrical industry co-operated in the work, together with a local real estate concern and a leading house furnisher who provided the setting for the electrical devices exhibited. About fifty appliances were shown, with adequate convenience outlets, in the seven rooms which compose the dwelling.

Public Utilities as Community Builders

By Henry Bostwick
Manager San Francisco Division Pacific Gas & Electric Company

IT HAS often been said that the prosperity of a community can well be judged by its public utilities, but I believe we should go a step further and say that all public utilities, particularly electric and gas companies, can and should be classed as community builders. However, the extent to which a utility assists in the upbuilding of a community and to what degree it merits being called a "community builder" depend in a large measure upon its public relations.

The Pacific Gas & Electric Company has given much thought and study to this matter of building and cementing better public relations. As an instance of what has been done along this line, it has been the practice of the company for some time to take parties of citizens on inspection tours through its various generating plants.

We feel that this has done more toward building better public relations than any other means that we could possibly have adopted. In the San Francisco division during the past year we have had the pleasure of a visit to our plants from the grade school teachers' association. There were 125 in this party, which visited the plants in the evening, and to use their own words: "It was an inspirational trip to all of us." Recently a women's organization known as the "See and Know San Francisco First Club" was conducted through the plants with the same result. In addition to personal visits to our plants representatives of the company are always glad to appear before any of the schools, mothers' clubs or other associations to tell about our industry. This practice

has always resulted in very favorable comment and appreciation from the members of these associations.

No branch of our service is receiving more constructive thought and application today than that of public relations. Not that we have been altogether neglectful of this important matter in the past, but conditions have arisen during the last three or four years which have brought it more forcibly to the attention of the managing heads of all institutions throughout the country, whether of a public or private nature. From our experience we believe that the central-station manager who is not taking advantage of such simple things as these inspection tours to foster and cement a better feeling toward and closer relations with his company in the community it serves is overlooking a valuable opportunity to build good will.

Central Station Sells 1,120 Washers in Thirty-Day Campaign

THE Utah Power & Light Company, with general offices at Salt Lake City, continued its record-breaking pace in the sale of washing machines during March of this year, when a total of 1,120 machines were sold in a thirty-day campaign which has been an annual feature of the company's commercial program for several years past.

To dispose of this number of machines in that time in a widely scattered territory with a population of approximately 350,000 people distributed over a large part of Utah, southern Idaho and western Colorado is a splendid example of real central-station selling. The company serves in its entire territory 62,000 residence customers. At the start of the campaign a quota of 1,000 machines was set as the goal. This quota was divided proportionately among the eight divisions of the company's territory, and competition among these divisions was aroused by offering cash prizes for those which exceeded their quota, for the division which made its quota first and for the division which exceeded its quota by the greatest percentage. As in previous campaigns, this arrangement was a strong factor in the success of the drive.

More than a thousand happy homes last March
Make Yours Happy Now
We Offer the AutoMatic Electric Washer
on Special Easy Terms for March Only
$1 down
$5 a month
Perhaps your neighbor has already told you the value of her AutoMatic—you know its superior service. Take advantage of this special offer NOW!
FREE!
"A Copper Washer for a Silver Dollar"
Utah Power & Light Co.

TYPE OF ADVERTISEMENT USED IN WASHING MACHINE DRIVE

Easy terms of $1 down and $5 a month were offered and proved very attractive to customers. A liberal amount of newspaper advertising was used in all of the papers published throughout the company's territory. All the advertisements carried a slogan "A Copper Washer for a Silver Dollar," and the convenience, labor and money-saving features were also played up. A particularly interesting publicity stunt used to advertise the sale was a parade of several truckloads of washing machines on the main street of Salt Lake City, carrying a total of seventy washers representing one day's sales. Other features used to put the campaign over were banners on street cars, company automobiles and trucks; the delivering of washing machines from the front doors of some of the company's stores; distribution of 1,000 caps bearing the slogan "A Copper Washer for a Silver Dollar" to newsboys and others; placarding of freight cars loaded with machines; lettering of the sidewalk in front of stores, and the demonstration of machines in homes.

Daily sales reports were received by the general sales department at Salt Lake from the company's various divisions, and daily bulletins were forwarded to division managers and salespeople showing the relative standing of each division. This kept the enthusiasm and rivalry at a high pitch throughout the campaign. Daily sales letters were also sent out, encouraging those actively engaged to use their utmost energy in order that the quota might be reached or exceeded.

About thirty-five people were actively engaged in the selling of the machines, including some office employees who devoted part of their time to the work. These salespeople all worked on the outside, with the exception of about twelve inside salesmen. As in the past, the generous use of advertising, the selling of a thoroughly dependable piece of merchandise and the offering of terms within reach of every one were important factors in making the campaign a success and establishing what is believed to be another record.

PARADE OF TRUCKS LOADED WITH SEVENTY WASHING MACHINES, ONE DAY'S SALES

Showing an Interest After Obtaining Business

MANY electric service companies will, when the question is raised, contend that they make every effort to show an interest in their customers after their application blank is signed, but the customers are not always so quick to agree with this contention. Actions speaks louder than words, and to make its service as near 100 per cent as possible the Georgia Railway & Power Company maintains a "greater service department." Four men are engaged in this department, which is really a field organization. They travel from customer to customer steadily, asking whether the service is satisfactory, if not why not, whether all equipment or apparatus is in service, and so forth. A record containing definite questions of this character is filled in for each customer and turned into the sales department promptly for immediate attention.

Minor repairs like mending of flat-iron cord are made by the "greater service" representative, but major repairs necessarily are reported to the central office with other statements regarding service. The troubles are then adjusted by the electric service company or, if it is not the duty of the company to attend to them, the customer is informed how to get the work done.

In addition to the relatively detailed investigations of the greater service department representatives, the company has recently instituted a system of inquiry and investigation which is carried on coincidentally with the meter reading. As the reader enters the home he greets the lady-of-the-house with a "Good morning (or afternoon) Mrs. Blank" and makes inquiry as to whether the service is satisfactory and if not, in what respect it is deficient. When the reader reports back to the office in the afternoon he turns in reports of any complaints or requests for appliance adjustments. This innovation has served materially to improve customer relations and the time required for gathering the information has not appreciably increased the cost or time required for meter reading.

A great many prospects for gas and electric appliances are obtained in this way.

In the event apparatus, piping or wiring is found in a condition dangerous to life or property, or installed in such a manner as to be the cause of high consumption, a personal letter signed by the general sales manager is sent to the customer immediately after the visit, stating that the field man has reported that such and such a condition prevails and that same should be remedied.

The psychological effect of such methods alone, if no other advantage accrued, is worth the expense and time, says C. A. Collier, general sales manager. Furthermore, they prevent complaints accumulating and growing into general dissatisfaction that could only be eradicated with difficulty.

Form 2-418—20M—4-5-22

CUSTOMER REPORT

Date .....

Name ..... Address .....

Service furnished: ELECTRIC LIGHTS, POWER, COOKING; GAS: COOKING, WATER HEATING.

Customer's statement of service, Electric ..... Gas .....

Complaint of Service, if any .....

Apparatus—Electric: Toaster, percolator, chafing dish, waffle iron, small stove, range, vacuum cleaner, sewing machine, washing machine, iron, ironing machine, dish washer.

Gas: Range, tank, heater, automatic heater, iron .....

Does customer wish broken apparatus repaired? .....

Attitude towards company .....

Remarks .....

Person interviewed Signed .....

A RECORD OF THE APPLIANCES IN SERVICE AND CUSTOMER'S ATTITUDE TOWARD THE COMPANY IS KEPT ON THIS FORM

What Other Companies Are Doing

Hartford, Conn.—Following the offer of a limited number of shares of its stock to customers and their families on a cash or an installment basis, 1,075 shares were sold in the first four days by the Hartford Electric Light Company. The shares were sold to net 6 per cent to the purchaser. In a statement announcing this customer-ownership plan, Vice - President Samuel Ferguson pointed out that such a distribution represents a true and efficient "public ownership of utilities," in contrast to the form commonly advocated in socialistic circles, which should be more properly entitled "political ownership."

El Paso, Tex.—The employees of the El Paso Electric Ralway Company have formed a beneficial association to provide medical aid for employees who may be injured or become sick while in the services of the company. The monthly dues are $1 per month and the benefits include in addition to doctor and hospital service a death benefit of $1,000. All employees of the company, both men and women, whether in the railway or light and power departments, are eligible to membership upon meeting the entrance requirements.

Montpelier, Vt. — In a recent six months' house-wiring campaign by the Montpelier & Barre Light & Power Company 3,536 outlets were added, an average of sixteen outlets per house. Eighteen towns were canvassed and 210 meters added to the system. Of 6,664 homes in the territory, 5,416, or 84 per cent, are now wired and being served by the company.

San Francisco, Cal.—The annual report of the Pacific Gas & Electric Company was broadcasted on April 10 from the Mercantile Trust Company's radio station. Wiggington E. Creed, president of the power company, delivered the message. This is the first annual report to the stockholders of a public utility that has been sent over the radiophone on the Pacific Coast.

Lowry City, Mo.—The West Missouri Power Company has purchased the Osceola Light & Water Company of Osceola, Mo. A transmission line will be constructed from Lowry City to Osceola to supply the electric service in Osceola, and the water plant will be equipped with motors so that it can be operated electrically.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Hydro-Electric Development in California.—G. C. TENNEY.—In its Big Creek-San Joaquin River hydro-electric project, where approximately $300,000,000 is being spent to produce and market 1,400,000 hp. of electrical energy, the Southern California Edison Company is keeping abreast of the ever-increasing power demands of the rapidly growing territory to which its service extends. This ten-page, amply illustrated article deals with the general engineering features of this project. Tables give the capacity of present power houses, connected load in horsepower, miles of transmission lines, number of meters employed, uses to which electrical energy is being applied, summary of tunnel lines in the Big Creek-San Joaquin development, and growth in number of stockholders.—*Journal of Electricity and Western Industry*, April 1, 1923.

Purification of Boiler Water.—F. H. RHODES.—The selection of the proper method of water purification is one of the important problems in any steam-power plant installation. In this selection there are several factors to take into consideration. These include not only the nature and the amounts of the impurities in the raw feed water and the costs of construction, operation and maintenance of the water-purification plant, but also the amount of water to be treated daily, the daily and seasonal variations in the amounts of impurities, etc. The author treats mathematically several methods for purifying water and illustrates each with an actual example.—*Sibley Journal of Engineering*, April, 1923.

Generation, Control, Switching and Protection

Synchronizing Torque of Ljungstrom Turbo-Generator Set.—T. KOMARU.—The author considers the power oscillation between synchronous machines of different frequency with special reference to the Ljungstrom turbo-generator set, discussing the circulating current between machines, exciters and generator characteristics.—*Journal of the Institute of Electrical Engineers of Japan*, March, 1923.

Transient Phenomena Arising in Transformers from Switching Operations.—S. A. STIGANT.—The occurrence, effects and prevention of the transient disturbances arising as a result of switching are considered under the divisions of (a) switching-in current rushes, (b) switching-in pressure rises and (c) switching-out pressure rises. The initial value of the current taken on low load by the transformer at the instant of switching in is determined by the point of the pressure wave at which switching in occurs and is also dependent on the magnitude and polarity of the residual magnetism which may be left in the transformer core after previous switching out. The exact conditions encountered when switching in and out at various points on the wave and with various amounts of magnetism remaining in the transformer coil are considered.—*Electrical Times*, April 5, 1923.

Developments in Auto-Valve Lightning Arresters in 1922.—A. L. ATHERTON.—A four-page abstract of this paper, presented at the midwinter convention of the A. I. E. E., may be found in the ELECTRICAL WORLD for Feb. 17, 1923, on page 385.—*Journal of the A. I. E. E.*, May, 1923.

Transmission, Substations and Distribution

Characteristics, Operation and Maintenance of Underground Cables.—A. I. TRACEY.—A page-and-a-half abstract of a paper presented before the Electrical Power Engineers Association (England). The author considers the general characteristics of a three-core transmission cable and how these characteristics function and discusses the operation and maintenance of such cables. The capacity of these three-core cables, their measurement and the determination of capacity current, self-induction characteristics, potential gradient, presence of moisture in the dielectric, relation of insulation thickness to working voltage, the concentration of stresses set up by local high-frequency current in cables, safe current with which a given cable can continuously stand and cable-jointing methods are other features covered.—*Electrical Times*, April 5, 1923.

The Neutral Grounding Reactor.—W. W. LEWIS.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. spring convention, May 5, 1923, on page 1020.—*Journal of the A. I. E. E.*, May, 1923.

Use of Single-Core Sheathed Cables for Alternating Currents.—W. CRAMP.—It is frequently a matter of convenience to use single-core, lead-covered cables for transmitting power by means of alternating current, and in such cases the magnitude of the loss arising from the eddy currents induced in the lead sheath becomes a matter of importance. The eddy losses in the sheaths of these cables may be divided into two groups, called "sheath eddies" and "sheath-circuit eddies." The latter occur only when one or more cables have their sheaths connected at more than one place. The losses are analyzed for a single cable, a pair of single-phase cables and a set of three-phase cables. It is shown that the sheath eddies are in all cases negligible and that the sheath-circuit eddies may be kept within reasonable limits by proper regulations regarding the spacing of each cable in respect to the others.—*Journal of the Institution of (British) Engineers*, April, 1923.

Units, Measurements and Instruments

Measurements of Transients.—F. E. TERMAN.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. midwinter convention, Feb. 24, 1923, on page 450.—*Journal of the A. I. E. E.*, May, 1923.

Comparison of Performance of Oil Circuit Breakers.—P. BENDMANN.—A number of oil switches, made by different concerns, are critically investigated as to their performance characteristics, such as ruggedness of contacts, depth of arc under the oil level, air space above the oil, churning of the oil and speed of opening. Two modern types of high-capacity switches are shown which embody most of the required characteristics for a dependable operation. Of special interest in these breakers are provisions to have the generated gas break up in small gas bubbles, contact knives arranged edgewise, a ventilated gas-accumulating chamber, arcing tips in a pressure-proof pot and compression air pockets to act as gas-pressure buffers.—*Elektrotechnische Zeitschrift*, March 15, 1923.

Preparation of Platinum and of Platinum-Rhodium Alloy for Thermocouples.—R. P. NEVILLE.—The Bureau of Standards has prepared in its laboratories thermo-element platinum and platinum-rhodium alloy for standard thermocouples, to determine what performance might justly be required of such instruments. The melting of the pure metal and of the alloy was carried out in an Ajax-Northrup high-frequency induction furnace in crucibles of lime and thoria. Platinum and platinum-rhodium alloy, superior in quality to the best material of this kind formerly in the possession of the bureau, was prepared.—*Paper presented before American Electrochemical Society, New York*, May 3-5, 1923

Illumination

Development of Electric Illumination of Railroad Cars.—H. LÖWL.—After a short description of the different systems used on European railroads to illuminate their coaches, the author describes an automatic system which uses an axle-driven direct-current generator of 300 watts to 3,000 watts output connected over an electromagnetically operated mechanism to a battery of twelve cells. To insure uniform polarity at forward or backward run the brush yoke of the dynamo is automati-

cally shifted. Under most unfavorable conditions the voltage applied to the lamps in the car may vary between 24 and 27.6, or a variation of 15 per cent. —*Elektrotechnik und Maschinenbau*, April 1, 1923.

Stage-Lighting Equipment and Its Application.—A. L. POWELL.—A comprehensive discussion of the possibilities and limitations of the various standard devices for producing the multitude of light and color effects demanded on the stage, with particular reference to foot and border lights, bunch and spot lamps, "effect" apparatus and colored lamps, together with some brief notes on switchboards and wiring, is given. The article is well illustrated, showing various types of lamps and lighting equipment employed.—*Electrical Record*, April, 1923.

Motors and Control

Induction-Motor Developments.—K. SACHS.—The author describes in this paper some of the latest designs of induction motors, selected from recent patent literature, with special centrifugally operated devices to start the motor with a wound armature and to short-circuit the winding at full speed. Such motors combine the easy start of the phase rotor with the desirable running characteristics of the squirrel-cage rotor. Some designers go even so far as to provide three steps of gradual short-circuiting, with a resistance mounted on and running with the shaft. Other models start with the rotor winding in "Y," then change it into delta, and finally short-circuit it. A motor with a centrifugal starting device, reliable and not too complicated, could be easily built as a totally inclosed type and would be a very useful machine in mines with explosive gases, doing away with starters having open or otherwise poorly inclosed contacts. *Bulletin de l'Association Suisse des Electriciens*, March, 1923.

Graphically Designed Starting Apparatus. — S. OGAWA. — The author describes a simple graphical method of designing a direct-current shunt and series-motor starter and starting compensator, taking into consideration the proper time elements.—*Journal of the Institute of Electrical Engineers of Japan*, March, 1923.

Heat Applications and Material Handling

Problems in Electric Furnace Operation.—F. V. ANDREAE.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. spring convention, May 5, 1923, on page 1024.—*Journal of the A. I. E. E.*, May, 1923.

Relation Between Current, Voltage and the Length of Carbon Arcs.—A. E. R. WESTMAN.—An account of the early work on the electric arc has been given by Mrs. Ayrton and a summary of present knowledge by Steinmetz. Each of these writers is the author of a formula connecting current, voltage and arc length; but in the experiments on which these formulas were based the currents ran up to only 30 amp. or so, and it seemed desirable to add to the experimental material. The paper under notice gives an account of measurements made with currents up to 770 amp.—*Paper presented before the American Electrochemical Society, New York*, May 3 to 5, 1923.

Electrophysics, Electrochemistry and Batteries

Battery Charging at the Chicago Mail Terminal.—W. LANDESS.—Facilities are provided at the Chicago Union Station mail terminal for the charging of tractor batteries and of all batteries on mail cars in the terminal. Switching and charging panels, car-lighting charging panels, generating and switching of power and motor-generator sets are described.—*Railway Electrical Engineer*, April, 1923.

Effect of Current Density on Overvoltage.—M. KNOBEL, P. CAPLAN and M. EISEMAN.—There are numerous references in electrochemical literature on the effect of current density on overvoltage, but they set up in general more or less isolated values and for comparatively small current densities. The experimental conditions are so different also that it would be difficult to compile a comparable set of data. On account of the great technical importance of this phase of overvoltage, and also for the theoretical interpretation of overvoltage, it was thought desirable to have extensive and consistent data in this field. In this article the authors have attempted to include all the more common metals and alloys as cathodes and to determine oxygen and halogen overvoltages on as many electrodes as possible. While the overvoltage values obtained may not be acceptable as absolute values, they should at least be comparable as the experimental conditions were maintained alike in all cases.—*Paper presented before American Electrochemical Society, New York*, May 3-5, 1923.

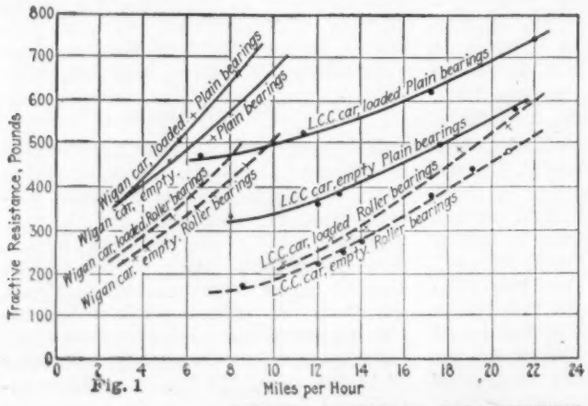
Telegraphy, Telephony, Radio and Signals

Radio as Applied to Telephony.—O. B. BLACKWELL.—The object of this paper is to give an idea of what radio is and what it means to the telephone business. The first part is intended to assist in forming a clear picture of the physical nature of both wire and radio transmission, while the latter part is a brief discussion of the fields of use for which radio has been developed or for which it has been considered.—*Electrical Communication* (published by the International Western Electric Company), February, 1923.

A High-Voltage Mechanical Rectifier.—S. T. WOODHULL.—A mechanical power rectifier for high-voltage direct-current production is described and its design and operation are discussed. This generator uses transformer action for the generation of the high voltage and a synchronous commutator for rectification.—*Proceedings of Institute of Radio Engineers*, April, 1923.

Traction

Roller-Bearing Tests on Railway Cars.—During the past two years tests on two single-truck cars of the Wigan Corporation Tramways and on one double-truck car of the London County Council have been made to determine the characteristics of cars equipped with plain bearings and with roller bearings. The accompanying illustrations show the tractive resistance at various speeds and coasting-distance curves for both types of bearings. Comparison was also made between the two types as regards starting effort and retardation.—*Electric Railway Journal*, April 21, 1923.


Tractive Resistance, Pounds
Miles per Hour
Wigan car, loaded, Plain bearings
Wigan car, empty, Plain bearings
LCC car, loaded, Plain bearings
LCC car, empty, Plain bearings
Wigan car, loaded, Roller bearings
Wigan car, empty, Roller bearings
LCC car, loaded, Roller bearings
LCC car, empty, Roller bearings
Fig. 1

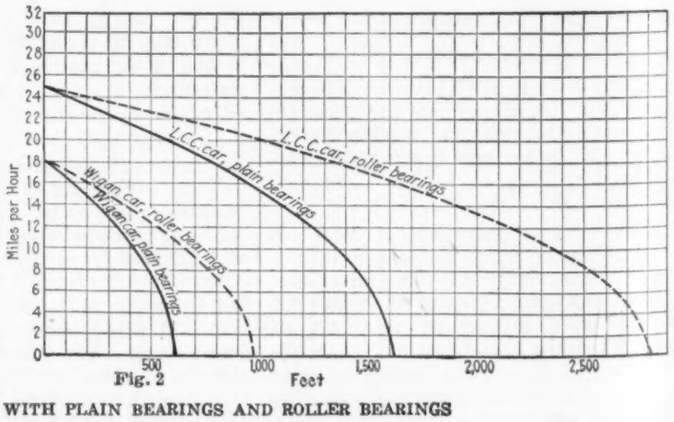


Fig. 2

RESULT OF TESTS ON CARS EQUIPPED WITH PLAIN BEARINGS AND ROLLER BEARINGS

Fig. 1—Tractive resistance at various speeds. Fig. 2—Coasting-distance curves.

Sciehtific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

Conducted by PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N.Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Cables, Lead, Protection Against Beetles

Beetles which bore through lead cables and which, nevertheless, do not or cannot penetrate pure gum rubber have proved a serious problem and pest in California and many other parts of the United States. Experiments indicate that the beetle is able to penetrate any lead alloy or any poison or repellent placed on it. Probably it is able to penetrate the poisons because it does not feed as it bores through. Beef tallow, when sufficiently soft, will stick to the beetle and suffocate it, and has been used with some success on the rings which suspend the cable. Layers of friction tape impede the boring, and thin sheets of copper, zinc, or steel prevent it.—*R. D. Hartman, H. E. Burke and T. E. Snyder, United States Department of Agriculture, Washington, D. C.*

Lubricating Oils, Petroleum, Reclamation of

By means of simple apparatus already commercially available used lubricating oil can be reclaimed and made as good as new, or even better. An investigation has shown this to be true, judging by all the commonly accepted standards. Certain changes in the oil could be detected by special tests, but it is a matter for future investigators to decide whether or not these changes are detrimental.—*Bureau of Standards, Washington, D. C.*

Phase Sequence Indicator

Various devices have been used for some years to indicate phase rotation on polyphase circuits. Arrangements of a more or less complicated nature have been made up and used locally by various operating companies, and during the past year a manufacturer has developed a phase-sequence indicator. This is a small portable device, consisting essentially of coils operating on a single lamp as an indicator. By two trials in connecting the binding post to a polyphase circuit the phase rotation can be determined. — *Instruments and Measurements Committee of the A. I. E. E.*

Poles, Impregnation of

Comparative experiments have been carried on concerning the open-tank method of treatment with creosote oil, using what is known as the "B" treatment, the puncture method and the closed-tank pressure method. The results indicate that better penetration can be obtained where the sapwood has been punctured before the open-tank treatment is applied. Where the puncture treatment is applied without lacerating the fiber of the pole the increased penetration will more than compensate for any small decrease in strength due to rupture of some of the other fibers.—*Overhead Systems Committee of the N. E. L. A.*

Solder for Aluminum

A study of the various solders for aluminum showed that the best results are obtained with compositions of zinc-tin and zinc-tin-aluminum. The tensile strength of a good aluminum solder is about 7,000 lb. per square inch, for those with higher tensile strength have, in general, their temperature of complete liquation too high for soldering purposes. Most of the metals commonly used in solders, except magnesium, are electropositive to aluminum, so that any metals used in making a soldered joint of aluminum act electrolytically in the presence of moisture as positive galvanic poles, accelerating the corrosion of the aluminum. Magnesium cannot be utilized advantageously even though it is electronegative to aluminum because the metal disintegrates rapidly in the presence of moisture. Soldered joints of aluminum which are to be exposed to moisture should be protected against corrosion by a paint or varnish.—*Bureau of Standards, Washington, D. C.*

Transformer with Nitrogen Above Oil

When arcing sufficient to cause a breakdown of the oil occurs below the oil level, exceedingly rapid internal pressures may be created by the evolution of gas. The air space above the oil level acts as a cushion until the safety diaphragm has time to act. On the other hand, the air is undesirable because it may form an explosive mixture with liberated gases. Moreover, the air causes the oil to oxidize, producing a sludge. For these reasons means have been developed for replacing the air by an inert gas such as the atmospheric nitrogen. The transformer tank is made to "breathe" through a deoxidizing compound, so that most of the oxygen contained in the air is absorbed before it reaches the space above the oil. (For details see the *Electric Journal*, 1923, Vol. 20, page 53.)—*W. M. Dann, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

Welding, Suitability of Various Materials for

Strips of various materials were created with vitreous enamel which was baked by the passage of an electric current through them. The materials tested were commercially pure-iron made in a basic open-hearth furnace, copper-bearing open-hearth iron, basic open-hearth mild steel, charcoal iron, Bessemer steel and silicon steel. In all cases except the open-hearth irons the enamel contained bubbles and blisters. The iron samples produced a perfectly smooth enamel surface free from any such defects. This indicates a freedom from gas or gas-forming constituents.—*J. H. Nead and R. L. Kenyon, American Bureau of Welding.*

In Progress or Purposed

Fuses for Potential Transformers

Some 13,200-volt potential transformers have such a high impedance that standard high-tension fuses do not always clear a dead short-circuit on the low-tension side, occasionally causing a transformer to blow up. It is almost impossible to obtain a fuse wire strong enough mechanically which would positively clear a secondary short-circuit. It is therefore recommended that the low-tension circuit of such a potential transformer be protected with a cartridge fuse of 15 amp. to 30 amp. rating.—*A. F. Bang, Pennsylvania Water & Power Company, Baltimore.*

Generating Stations, Artificial

Work is being done upon the representation to a small scale of the effect of two independent generating stations feeding an artificial network. With more than one generating station some method of controlling the outputs must be obtained, and we are investigating the possibilities of using phase shifters with voltage control as artificial generators. At the same time work is proceeding on the possibility of making a synchronous motor, driven by a shunt direct-current motor, which will have the characteristics of a turbo-generator when reduced to the scale upon which the artificial lines are built.—*Vannevar Bush, Massachusetts Institute of Technology, Cambridge, Mass.*

Insulator Troubles Due to Cement

The committee is continuing its studies on high-tension porcelain insulators, with special reference to the type of cement used between units. One of the difficulties which resulted in the failure of both pin-type and strain-type insulators has been the growth of cement. Where the design of the insulator does not allow for this growth the porcelain has in many cases been ruptured. Experiments show that the percentage of growth can be considerably reduced by the use of proper kinds of cement and by the proper curing. The trouble may also be eliminated by proper design of the cemented joint to allow for such growth.—*Overhead Systems Committee of the N. E. L. A.*

Transmission Lines, Transient Phenomena in, Experimental Study of

A study was made last winter of direct-current transients upon a smooth single-phase line. We are now working upon alternating-current transients on both the single-phase and three-phase line. This will involve first a measurement in the simple case where the current is measured at the home end and the far end of the line, either open or short-circuited. After that, the transients will be measured at different parts of the line and with different terminal conditions. An oscillograph is used in conjunction with a vacuum-tube repeater where power drawn from the line will introduce distortion.—*Vannevar Bush and F. S. Dellenbaugh, Jr., Massachusetts Institute of Technology.*

Suggestions for Research

Cables, Thermal Problems in

In some tests it has been discovered that the variation in the thermal resistivity of the insulation and the emissivity of the lead on two samples of cable that were supposed to be exactly alike were sufficient to cause a difference of 10 per cent in the carrying capacity of the cable if this were determined by the maximum temperature of the copper. Some English engineers include in their cable specifications a clause which requires that the thermal resistivity of the insulation should not exceed a certain specified amount. In this country we do not have sufficient information regarding the thermal resistivity of the cables as made by the several manufacturers, nor for that matter do we know the range in the cables supposedly alike turned out by any one manufacturer. — *Cable Research Sub-Committee of the N. E. L. A.* [The University of Wisconsin and the Harvard Engineering School have signified their intention to co-operate with the sub-committee in problems of this kind. It is hoped that other engineering schools will also be willing and able to help in the elucidation of these important problems.—EDITOR.]

Corona in Air Spaces, Preventing by Metallization

The problem of designing electrical machines and equipments for the high voltages which are now becoming common is mainly one of insulation. As important as the quality of the insulation are the configuration of it and of the electrodes and the combinations of the dielectrics of different permittivities so as not to lead to high or non-uniform dielectric flux densities. In a high-voltage generator, for instance, the mica insulation, on the part of the coil inserted in the slot, is in series with an air layer in which, owing to the low permittivity of air, corona may occur. To prevent it studies were made on coils covered with a conductor, as tinfoil, which when connected to the iron of the machine short-circuits the air space. This arrangement, however, is very delicate, since the tinfoil may be destroyed during the assembling of the coils. Better results could be obtained by the metallization process recently developed by Schoop for the galvanizing of structures. The same process may be advantageously used in other cases such as giving metallic coatings to parts of built-up insulators, so as to distribute the potential.

Corona Loss, Theory of

Peek, Townsend, Whitehead, Kunz and others have investigated the laws of corona formation between a wire and a concentric cylinder, both theoretically and experimentally. The actually observed voltage at which corona begins, as a function of the air density, pressure and the dimensions of the electrodes, has been shown to be in good agreement with the general theory of ionization by collision and sparking between parallel plates. However, the theory has not been extended to include the actual energy loss due to corona, and Peek's emperical formula is being used. An extension of the theory of ionization by collision to account for the actually observed power loss is desired.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

New York State Officials Enlightened

Those in Charge of Action Against Constitutionality of Federal Water-Power Law Meet Federal Power Commission and Some Misconceptions Are Cleared Up

A RECENT appearance of the Attorney-General and State Engineer of New York, along with other interested New York state officials, before the Federal Power Commission has given further color to the belief that the state administration is attempting to back out gracefully from under its bill of complaint attacking the constitutionality of the water-power act. The conference is understood to have resulted in making clear to the representatives of the New York administration that the Federal Power Commission does not interpret the water-power act as strictly as is alleged in the bill of complaint. It is understood that the New York delegation admitted that the bill was in error to that extent. It also was admitted, it is said, that many limitations on the commission had been entirely overlooked in the bill, which led to a wrong conclusion as to the scope of the commission's power.

The New York delegation made much of a ruling by Mr. Taft when he was Secretary of War to the effect that the federal government's interest in water-power development was limited to its effect in improving or injuring navigation. Apparently there was failure to take into account that Mr. Taft rendered his opinion when the only federal legislation on the statute book was the general dam act.

The recapture phase of the water-power act came in for extended discussion, it is understood. New York considers itself the proprietor of the bed and banks of streams and contends that the exercise of the recapture provision of the act by the Federal Power Commission would be taking away from New York property over which the federal government has no jurisdiction. The New York delegation was advised that under the recapture phase of the act the federal government merely sets up a means of determining how recapture is to be carried out provided the United States has the authority to take over the project.

No Danger to Barge Canal

It also was pointed out that in so far as the Barge Canal is concerned no license could be issued covering the use of that water until the applicant could show full compliance with the state law and that the commission never has entertained any application on the Mohawk River and never would attempt to take jurisdiction over a project which would affect the water supply of the canal.

New York takes exception to the action of the Federal Power Commission in giving a preliminary permit to the Lower Niagara River Power & Water Supply Company, covering the Niagara Gorge development. How did the commission know, it was asked, that the State of New York did not prefer that the preliminary permit be given the Niagara Gorge Railway Company, whose application the Federal Power Commission rejected? The answer in that case was that the preliminary permit was granted to the Lower Niagara company before New York had set up its Water Power Commission. The Lower Niagara company presented acts of the New York Legislature granting certain franchises to that company, evidently sufficient proof to convince the commission that it had the necessary state authority to go ahead with the development. Any preliminary permit is granted with the understanding that the applicant must secure state authorization for development before the license is issued, but in cases that are at all important it is the policy of the commission to confer with the state authorities directly to ascertain their feeling toward the project.

There is every reason to believe that the conference has resulted in a material clearing of the atmosphere. Practically the only point of difference which was not eliminated at the conference was that as to the scope of the federal authority over water power. The federal government bases its authority to control floods, further irrigation and regulate water-power development on the rights over navigation granted it by the Constitution, just as it bases many activities on the interstate commerce clause of the Constitution. Since the Supreme Court has upheld many apparently far-fetched activities related to commerce, it is believed that the water-power act will be upheld as the control exercised over power development is a contractual relationship incident to the protection of the navigability of streams.

Savings in Fire Insurance

Through Efforts of National Electric Light Association Committee Electric Light and Power Companies Receive Lower Premium Rates

DURING the last twelve months member companies of the National Electric Light Association have received reductions in premium rates for fire insurance on electric generating and substation property amounting in the aggregate to more than the total dues paid into the N. E. L. A. treasury by electric light and power companies.

In the opinion of Charles B. Scott, chairman of the insurance committee, and S. E. Wolff, vice-chairman, this is but the beginning, as the full benefits of the movement under way will not be realized until all companies have taken advantage of the work of the committee and asserted their right to a reinspection of their properties and a revision of their rating schedules. It is said, too, that a tremendous amount of detail work remains to be done before the greatest benefits will be obtained by the industry as a whole.

At the N. E. L. A. convention in Atlantic City last year the insurance committee reported that it had arranged with representatives of the fire insurance underwriters for a revision of rating schedules applying to electrical generating and substation properties. This arrangement was brought about through the adoption of a resolution by the underwriters authorizing a reduction of not to exceed 25 per cent on all premium rates on this class of property. This reduction was to apply to the business as a whole, with the understanding that schedules would be so arranged as to reward the reduction or elimination of fire hazard through good standards of construction, housekeeping, etc., while properties whose conditions did not reflect good standards of construction with a reduction of the fire hazard were to receive a lesser benefit. This agreement made necessary the devising of new forms of rating schedules and their subsequent adoption by the several insurance rating bureaus of the country. After the arrangement of these schedules and their adoption by

SAVINGS IN COST OF CENTRAL-STATION FIRE INSURANCE UNDER NEW RATINGS

	Amount of Insurance Carried	New Rate per $100 Value (Cents)	Annual Savings Amount	Annual Savings Per Cent
Alabama Power Co.	$7,731,050	11.4	$2,916.61	25.2
Helena (Ark.) Gas & Electric Co.	210,000	17.8	90.30	19.5
Western States Gas & Electric Co.	418,550	89.4	1,171.94	24
Colorado Power Co.	529,300	80	938.00	17.5
Pensacola (Fla.) Electric Co.	802,000	49.5	95.60	5.7
Georgia Railway & Power Co.	2,270,000	19.05	647.05	12.5
Illinois Traction System	629,975	25.9	497.69	23.4
Wabash Valley Electric Co.	180,000	16.8	657.00	37.5
Iowa Southern Utilities.	319,325	17.3	1,050.58	31
Lexington (Ky.) Utilities Co.	200,740	27.7	664.45	54.4
Central Maine Power Co.	2,647,475	125*	3,309.68	23.1
Consolidated Gas, E. L. & P. Co.	8,915,000	9.741	4,471.16	33.9
Springfield (Mass.) Electric Light Co.	780,000	23.59	396.24	17.7
Citizens' Light & Power Co., Adrian, Mich.	58,200	104.8	96.61	32
Duluth Edison Electric Co.	$300,000	56.1	$750.00	30.8
Ozark Power & Water Co., Branson, Mo.	91,000	103.8	56.42	5.6
Nebraska Power Co.	2,500,000	11.41	2,028.79	41.7
Electric Light & Power Co., Hightstown, N.J.	9,000	66.85	10.80	15.2
Santa Fé Water & Light Co.	49,700	134	303.17	31.3
Genesee L. & P. Co., Batavia, N. Y.	126,000	112	516.60	26.8
Fessenden (N. D.) Light & Power Co.	13,000	174	35.10	13.4
Northern Ohio Traction & Light Co.	4,607,645	17.6	2,395.98	22.7
Northwestern Elect. Service Co., Erie,	137,400	20.75	218.41	43.4
Tennessee Electric Power Co.	1,520,138	34.27	1,378.77	20.9
Warrenton (Va.) Electric Light & Power Co.	36,000	85.48	57.67	16
Natrona Power Company, Casper, Wyo.	105,000	84.67	675.46	44

* Three years' rate.

the bureaus, reinspection of properties to which they were to be applied was necessary before the benefits could be enjoyed.

Since May, 1922, revised schedules have been put into effect throughout the United States, except in the States of Kansas, Mississippi, Texas and parts of the New England States, and have been applied generally on the properties of member companies.

During April Chairman Scott requested member companies to report the progress of reinspection work and the results obtained. He requested that replies be made in time to reach him not later than May 10, and as of that date eighty-four companies had given complete information. Under the revised rating schedules the premium savings on this insurance amount to more than $96,000 annually, or 24.3 per cent of premiums paid under the old rating schedules.

Complete data are not available, but in order to give an idea of the results generally obtained, examples were chosen at random from the states where the schedules are in effect and are printed in the accompanying table.

The committee finds that a great many central-station companies have not had reinspections of their property and seem to be unaware of their right to demand such reinspections. In other cases central-station managers seem to take little interest in the proposition and are not co-operating with the insurance interests to get the best results. Thus, while the general results are fairly satisfactory to the committee, it will, as already said, require a great deal of attention to details to reap the full benef

Contract Let for Ouachita River Dam

A contract for the construction of the Remmel Dam on the Ouachita River between Malvern and Hot Springs, Ark., has been awarded to Ford, Bacon & Davis by the Arkansas Power & Light Company of Pine Bluffs. This dam, from which 15,000 hp. will be developed, is the first of a series of three hydro-electric plants on the Ouachita River that will eventually develop 120,000 hp. The Remmel Dam will be 60 ft. in height and 900 ft. long at the crest. The lake formed back of the dam will cover about three thousand acres of ground. The new plant will tie into the transmission system of the Arkansas Power & Light Company, which already has transmission lines within a few miles of the plant site.

Hot Springs Central Station Little Harmed by Flood

A telegram to the ELECTRICAL WORLD from S. E. Dillon, general manager of the Citizens' Electric Company, Hot Springs, Ark., says that service was suspended for only about three hours when a flood temporarily overwhelmed that city early this week. Fire destroyed sections of the company's lines, but the loss was nominal. The water came up to the pump station, forcing the shutting down of the plant for the length of time mentioned. Street-car service was discontinued for about twenty-four hours, but newspaper accounts of conditions in the city were, Mr. Dillon says, exaggerated.

Residence Load Building

This and Public Education in Matters Affecting Utilities Are Leading Topics at Fort Worth

RESIDENCE load building occupied a large share of the attention of the delegates to the annual convention of the Southwestern Public Service Association, held in Fort Worth, Tex., this week. At the Commercial Section meeting on Wednesday morning it was pointed out that in spite of the efforts devoted to appliance sales the average kilowatt-hour residential sales have not increased materially. A warm discussion of the possibilities of the electric range took place in which several took the position that electric ranges are not a desirable load because of the expense in distribution equipment required to carry them and the excess transformer capacity required.

J. H. Gill of the Dallas Power & Light Company said that fears as to the effect on transformer capacity were not well grounded and that the effect on the peak loads is merely to broaden them, as experience has shown that the range peak occurs fifteen to thirty-five minutes earlier than the peak due to other evening loads. Service difficulties, he said, should not be allowed to stand in the way of range-load development as these difficulties are no greater than those involved in developing the use of any load-building devices. Mr. Gill said that the way to successful load building involved a strict control of both the commercial man and the engineer responsible for distribution system building, so that the commercial man, on the one hand, will not be allowed to scatter ranges in such a way that individual distribution equipment for each range is required and the engineer, on the other, will not to be allowed to provide equipment to meet theoretical conditions that practical experience has shown do not exist.

Care in handling transformers during installation was urged in a discussion of transformer maintenance schedules, it being shown that if linemen are allowed to grasp the leads in handling distribution transformers the bushings are damaged and a breakdown may be the consequence. The use of slings that hook into either eyes or lugs provided for lifting purposes was urged.

H. C. Abell of the Electric Bond & Share Company, New York, recounted four processes that must be gone through in building public understanding of utility problems. Utility employees must be educated to understand utility problems so that they can talk intelligently and sympathetically of them to those with whom they come in contact. The people of the community must then be brought to an understanding of the utility problems. State education along these lines must be done through general bodies like the public utility information committees, and national education must be carried on through national associations.

Dr. E. B. Shurter of the University of Texas dwelt on the value of public speaking as a means of educating the public in utility problems and their relation to community welfare. H. B. Flowers of the New Orleans Public Service Company deprecated any effort at concealing facts concerning the utilities.

The convention, which included sessions of the railway and gas associations, lasted from Tuesday to Thursday inclusive, with a banquet on Wednesday and a Texas barbecue on Thursday.

N. E. L. A. 1923 Convention Program

(Tentative Draft Subject to Revision)

General and Executive Sessions

TUESDAY, JUNE 5, 9:30 A. M.

"Greetings to the Industry," Thomas A. Edison.
Address of President Smith.
Report of Treasurer Neumuller.
Report of membership committee, H. K. Mohr.
Report of Executive Manager Aylesworth.
Report of committee on constitution and bylaws, W. C. L. Eglin.
National Section reports: Public Relations, H. T. Sands; Accounting, William Schmidt, Jr.; Commercial, O. R. Hogue; Technical, R. F. Schuchardt.

WEDNESDAY, JUNE 6, 9:30 A. M.

Report of company employees' organizations committee, R. B. Grove.
Report of rural-lines committee, G. C. Neff.
Address, O. E. Bradfute, president American Farm Bureau Federation.
Report of water-power development committee, F. T. Griffith.
Address, Gen. Guy E. Tripp.
Report of Joint Committee for Business Development, E. W. Lloyd.

THURSDAY, JUNE 7, 9:30 A. M.

Report of accident prevention committee, C. B. Scott.
Report of customer-ownership committee, M. R. Bump.
Address, Dwight N. Lewis.
Report of insurance committee, C. B. Scott.
Address, Julius H. Barnes, president U. S. Chamber of Commerce.
Address, Lewis E. Pierson, chairman of board Irving Bank-Columbia Trust Co.
Report of committee on electrical resources of the nation, M. S. Sloan.
Report of memorial committee, W. H. Onken, Jr.

FRIDAY, JUNE 8, 9:30 A. M.

Report of committee on Doherty and Billings prizes, A. S. Loizeaux.
Report of wiring committee, R. S. Hale.
Address, O. C. Merrill, executive secretary Federal Power Commission.
Report of joint fuel committee, J. W. Lieb.
Report of rate research committee, Alex Dow.
Report of public policy sub-committee on inductive co-ordination, R. F. Pack.
Report of merchandising policy committee, John F. Gilchrist.
Report of lamp committee, W. W. Freeman.
Report of committee on constitutional revision.
Report of resolutions committee, W. W. Freeman.
Election of officers and members national executive committee.
Installation of president-elect.

Technical Sessions

MONDAY, JUNE 4, 2 P. M.

Session subject: "Problems of Electricity Generation"

Address, Chairman R. F. Schuchardt.
Report of prime movers committee, C. F. Hirshfeld.
Report of hydraulic power committee, O. G. Thurlow.
Report of electrical apparatus committee (generating station portion), R. H. Tapscott.

Symposium on Steam Plant Generation, High Steam Pressures and Temperatures.

Address, Charles H. Merz, London.
Address, Fred N. Bushnell.
Address, "Pulverized Fuel for Central Station," Prof. A. G. Christie.
Address, "Useful Life of Turbines," Peter Junkersfeld.
Address (speaker to be selected).
Address, "Comparison of American and European Practices of Waterwheel Construction and Water-Power Development," H. B. Taylor, Wm. Cramp & Sons.

TUESDAY, JUNE 5, 2:15 P. M.

Session subjects: "Problems of Conversion," "Problems of Metering."
Report of nominating committee, J. C. Martin.
Election of section officers and executive committee.
Address, "The Status of the Safety Code," Thomas Sproule.
Report of electrical apparatus committee (substation portion), R. H. Tapscott.

Symposium on Substation Equipment.

Address, "Power-Tube Possibilities" (speaker to be selected).
Address, "Storage Batteries on Metropolitan Systems," Philip Torchio.
Address, "Bulk Supply to Industries," Alex Dow.
Report of motor committee, W. L. Wadsworth.

Symposium on Metering.

Address, "The Place of the Meter in Industry," F. G. Vaughan.
Address, "The Education of Metermen," F. D. Paine.

WEDNESDAY, JUNE 6, 2:15 P. M.

Session subjects: "Problems of Transmission and Distribution," "Problems of Utilization."
Report of overhead-systems committee, L. M. Klauber.
Report of underground-systems committee, G. G. Post.
Report of electrical apparatus committee (motor rules and service voltages), R. H. Tapscott.

Symposium on Transmissions of the Future.

Address, Frank G. Baum.
Address, William S. Murray.

THURSDAY, JUNE 7, 2:15 P. M.

Session subject: "Interindustry Co-operation on Inductive Co-ordination."

Committee on inductive co-ordination will stage typical negotiations between a power company and a telephone company for the co-ordination of all power and signal lines.

Commercial Sessions

MONDAY, JUNE 4, 2 P. M.

Address, Chairman Hogue.
Report of committee on electrically equipped furniture, Ralph Neumuller.
Report of Electric Truck and Car Bureau, Charles R. Skinner, Jr.
Report of electric vehicle school committee, E. S. Mansfield.
Address, "Lowering Transportation Costs by the Use of Electric Trucks in the Warehouse Industry," Charles S. Morris.
Address, "Supervision of the Motor-Truck Equipment of New York Utility Companies," John Stilwell.
Address, "The National Increase in the Use of Electric Trucks," William Van C. Brandt.
Report of committee on commercial service and relations with customers, Harold Wright.
Report of education committee, Fred R. Jenkins.

TUESDAY, JUNE 5, 2:15 P. M.

Report of Lighting Sales Bureau, G. Bertram Regar.
Report of division on commercial aspects of lamp equipment, G. H. Stickney.
Report of sign, display and billboard lighting division, H. H. Magdsick.
Report of division on lighting of large buildings, C. C. Munroe.
Report of street and highway lighting division, L. A. S. Wood.
Report of industrial lighting division, J. Carl Fisher.
Report of residence-lighting division, M. Luckiesh.
Report of store-lighting division, James Kirk.

WEDNESDAY, JUNE 6, 2:15 P. M.

Report of Power Sales Bureau, C. K. Nichols.
Report of competitive power division, H. H. Holding.
Address, William S. Murray.
Report of industrial-heating division, Wirt S. Scott.
Address, C. F. Hirshfeld.
Report of general power division, Ernest Pragst.
Address, D. B. Rushmore.

THURSDAY, JUNE 7, 2:15 P. M.

Report of Merchandise Sales Bureau, F. D. Pembleton.
Report of division on education and training of salespeople, E. A. Edkins.
Report of sales analysis division, W. R. Collier.
Report of standardizing and testing division, R. S. Hale.
Report of division on basis of paying salespeople, H. A. Lewis.
Report of electric cooking and heating division, C. O. Dunten.
Election of section officers and executive committee.

Public Relations Sessions

MONDAY, JUNE 4, 2 P. M.

Address, Chairman Sands.
Report of committee on employee relations with public, L. B. Herrington.
Report of committee on co-operation with educational institutions, John C. Parker.
Report of committee on manufacturers' advertising, P. L. Thomson.
Report of committee on public speaking, A. C. Marshall.
Report of Information Bureau organization committee, H. C. Abell.
Report of committee on relations with financial institutions, M. S. Sloan.
Report of women's public information committee, Miss O. A. Bursiel.
Election of section officers and executive committee.

TUESDAY, JUNE 5, 2:15 P. M.

Session subject: "State Public Utility Information Bureaus."
Address, Frank A. Munsey.
Address, Bruce Barton.
Address, George E. Lewis.
Address, "The State Committee," W. W. Freeman.
Symposium by directors and members of the state public utility information committees.

WEDNESDAY, JUNE 6, 2:15 P. M.

Session subject: "Developing Public Relations—How? Why?"

Address, M. H. Aylesworth.

Symposium from Viewpoint of State Regulatory Authorities.

Six addresses by public service commissioners (names to be announced).
Symposium from Viewpoint of Member Company Executives.
Addresses by W. E. Creed, P. S. Arkwright, S. R. Inch, W. W. Freeman, Martin J. Insull, J. F. Owens, Dwight N. Lewis and Owen D. Young.

Accounting Sessions

MONDAY, JUNE 4, 2:15 P. M.

Address, Chairman Schmidt.
Report of committee on purchasing and storeroom accounting, J. F. Torrence.
Report of committee on accounting education, Fred R. Jenkins.
Report of committee on preservation of records, Franklyn Heydecke.
Report of filing systems committee, E. W. Kells.

TUESDAY, JUNE 5, 2:15 P. M.

Report of committee on classification of accounts and annual reports, W. J. Meyers.
Paper, "Uniform Classification of Accounts," Fred W. Herbert.
Report of committee on accounts-payable records, E. A. Davis.
Report of committee on fixed capital records, C. M. Breitinger.

WEDNESDAY, JUNE 6, 2:15 P. M.

Report of committee on security holders' records, G. B. Thomas.
Report of committee on customers' records and billing methods, B. F. McGuire.
Report on budget, D. W. Harris.
Report of payroll standardization committee, A. B. McCoard.

THURSDAY, JUNE 7, 2:15 P. M.

Election of section officers and executive committee.
Address, Carl D. Jackson.
Report of merchandising accounting committee, P. H. Myers.
Report of committee on mortgage and trust agreements, Walter C. Lang.

Program for Swampscott

Arrangements for Summer Convention of A. I. E. E. Are Rapidly Taking Shape

ARRANGEMENTS for the summer convention of the American Institute of Electrical Engineers, to be held at Swampscott, Mass., on June 25-29, have taken final shape, and an excellent program has been drawn up by the committee in charge. The technical sessions will be held in the mornings; in the afternoons there will be tennis, golf, bridge and trips to points of interest, electrical, historical and other, for the delegates and the ladies accompanying them, while entertainment, dancing and special features will fill the evenings. Monday will be devoted largely to registration, though there will be a meeting of section delegates from 10 a.m. to 12:30 p.m. as well as from 2 p.m. to 4 p.m.

The technical program prepared, subject to possible changes, is as follows:

TUESDAY MORNING, JUNE 26

Address of welcome, Governor Cox.
President's address, Frank B. Jewett.
"Cable Charge and Discharge," Dr. Charles P. Steinmetz.
"Dielectric Strength Ratio Between Alternating and Direct Voltages," J. L. R. Hayden and W. N. Eddy.
"Cable Geometry and Calculation of Current-Carrying Capacity," D. M. Simons.

WEDNESDAY MORNING, JUNE 27

(Parallel Session No. 1)

"The New Weymouth Station," J. Pope.
"Cooling of Electric Machines," G. E. Luke.
"Free and Forced Convection of Heat in Gases and Liquids," C. W. Rice.

(Parallel Session No. 2)

"Electric Plant for Transoceanic Radio Telegraphy," E. F. W. Alexanderson, A. E. Reoch and C. H. Taylor.
"Electric Plant for Transoceanic Radio Telephony," O. M. Arnold and Lloyd Espenschied.
"Measurement of Frequency Over the Communication Range," J. W. Horton, Messrs. Ricker and Morrison.
"Telephone Equipment for Long-Distance Cable Circuits," C. S. Demarest.
"Electrical Loud Speaker," A. Nyman.

THURSDAY MORNING, JUNE 28

"Transmission-Line Transients," V. Bush.
"Artificial Transmission Lines with Distributed Constants," F. S. Dellenbaugh.
"General Consideration of T and Pi Artificial Lines in Connection with a Proposed Compensated Pi Line," H. Nukiyama.
"Miniature Alternating-Current Transmission Systems," O. R. Schurig.
"Proximity Effect in Wires and Thin Tubes," H. B. Dwight.
"Simplified Method of Analyzing Short-Circuit Problems," R. E. Doherty.
"The Floating Neutral," L. S. Doggett.

FRIDAY MORNING, JUNE 29

(Parallel Session No. 1)

"Quality of Incandescent Lamps," J. W. Howell and H. Schroeder.
"Art of Sealing Base Metals Through Glass," W. G. Houskeeper.
"Measuring Instrument Standards," H. B. Brooks.
"Continuous-Current Generator for High Voltage," S. R. Bergman.
"Duplication of Electric Side of Power Stations," W. F. Sims.
"Pellet-Type Oxide-Film Arrester," N. A. Lougee.

(Parallel Session No. 2)

"Gaseous Ionization in Built-up Insulation," J. B. Whitehead.
"Effect of Transient Voltages on Dielectrics," F. W. Peek, Jr.
"The Axially Controlled Magnetron," A. W. Hull.
"Photographic Study of High-Voltage Discharges," K. B. McEachron.

Among the special features of the gathering will be the president's reception on Tuesday evening; an illustrated lecture by Prof. C. E. Magnusson on Wednesday afternoon; a lecture on the "North Sea Barrage" by Capt. R. R. Belknap, U. S. N., on Thursday evening; symphony concerts by radio, and special illumination of the building and grounds at 9 p.m. on Tuesday and Wednesday.

Arizona Still Recalcitrant

Governor Promotes the Policy of State Control and Ownership of Colorado Projects

ARIZONA apparently still persists in her opposition to the seven-state treaty governing the development of the Colorado River, which, it will be recalled, was defeated in the Legislature of that state, all the other six states concerned accepting it. News comes from Phoenix that on May 9 more than thirty men met with Governor Hunt and indorsed a policy of state control and eventual state ownership of all power projects developed on the Colorado within the state boundaries. This policy has been christened the "Arizona plan," and to further it Governor Hunt appointed a committee of nine men to draw up development plans.

Two plans were presented, the McGregor plan and the Greenway plan. The former looks to the immediate ownership and control of any development that may be undertaken by a nonpartisan commission, state ownership to be acquired by a bond issue tentatively set at $100,000,000. The Greenway plan looks first to the ratification of the Colorado River pact and the control by the state of development works constructed by private capital, with the privilege to the state of acquiring them by purchase when they shall be found to be profitable.

Still another plan is advocated by former State Engineer Maddock under which Arizona would settle its differences with the other states of the lower basin and, by reason of the close relation existing between Arizona and California because of the Imperial Valley, California would be asked to co-operate in and participate in the expense of any development undertaken.

At Santa Barbara, Cal., on June 7-9 the League of the Southwest will hold a meeting to discuss the Santa Fé pact. Governor Sweet of Colorado has, however, announced that he will not send a representative because to do so might be construed as "interference with the exercise of the sovereignty of a sister state."

Will Cross Main Sierra Nevada Ridge

First Transmission Line to Do So Has Been Authorized by the California Commission—Pacific Gas & Electric and Truckee River Power Companies to Be Interconnected.

THE ten-year contract between the Pacific Gas & Electric Company and the Truckee River Power Company reported in the ELECTRICAL WORLD for March 24, page 709, providing for the construction of the first transmission line to cross the main ridge of the Sierra Nevada Mountains separating California from Nevada has been approved by the California Railroad Commission. The Pacific Gas & Electric Company will build a 60,000-volt line from its present system to a point at the top of the mountains near Summit, Placer County, and will deliver energy there to an amount not in excess of 5,000 kw.

At this point the line will connect with a line being built by the Truckee River Power Company, which supplies light and power to Reno, Sparks, Virginia City and contiguous points in Nevada. Increased demands for power in the mining districts and the development of pumping for irrigation purposes have forced the Truckee River Power Company to augment its supply. The energy delivered over the new line is to be charged for at the regularly filed rates of the Pacific Gas & Electric Company, the Truckee River Power Company making an advance payment of a portion of the cost of the transmission line, which will be refunded by an annual discount of 20 per cent upon future bills of the Truckee River Power Company, which guarantees a minimum annual bill of $20,000.

This enterprise will mark another step in the development of interconnected systems in the Pacific and Mountain States. As ELECTRICAL WORLD readers are aware, there now exists a continuous transmission line from Albany, Ore., to the Mexican border, formed by the connection of the lines of the Mountain States Power Company operating in central Oregon, the California Oregon Power Company in southern Oregon and northern California, the Pacific Gas & Electric Company in northern and central California, the San Joaquin Light & Power Corporation in the San Joaquin Valley, the Southern California Edison Company in southern California, the San Diego Consolidated Gas & Electric Company, whose lines reach to Tiajuana, and the Southern Sierras Power Company, whose lines reach the border of Mexicali.

More than thirty steam generating plants and almost one hundred hydroelectric plants feed into this system, and their combined output is available for the combined requirements of all.

Only four comparatively small gaps in the transmission systems of the northern states remain to interrupt a continuous line from Yuma north through California and Oregon to Puget Sound and easterly across Washington and Idaho to Billings, Mont.

Nine-State Power Survey

Committee of Great Lakes Section, N. E. L. A., Doing Its Work on Comprehensive Scale

INTENSIVE work on the comprehensive electric power survey of the Great Lakes area, with the ultimate object of saving millions of tons of coal and bringing an uninterrupted flow of cheap electrical energy to cities, farms and industries in nine states, has been started, according to a report made by the power survey committee of the Great Lakes Section of the National Electric Light Association. The committee has determined to confine its first recommendation to the area covered by the southeast corner of Wisconsin, most of Illinois and Indiana and the northwest corner of Ohio. Its study is designed to show where it will be most economical and most advantageous to develop electric power up to 1950, to the end that all future extensions may be made in conformity with a definite plan. The entire region which will be studied includes Wisconsin, Michigan, Illinois, Indiana and parts of Minnesota, Iowa, Missouri, Ohio and Kentucky.

"The electric supply industry is no longer a purely local business," says the report. "Large generating stations and water powers are no longer merely local or state assets. They are the resources of the entire nation. It is now economically wrong to restrict the energy derived from them within any arbitrarily chosen limits. This energy must be so distributed that it will benefit the greatest possible number of people.

"'The outstanding feature of our future development plans is to provide a common reservoir from which electricity can be drawn at any point for any purpose, be it for lighting a home, operating a factory or providing power for railroads. Not until the power for the future is made only at the most economical points, and not until every available source of power that can be economically developed is put into use, will all the people derive the full benefits of electricity.

"In the earlier years little thought was given to the advantages of ultimate interconnection. We now will plan to base all future development on growth in population and industrial expansion, accessibility to coal fields and waterways and the labor market. The general location of large and small generating stations will be determined and reasons for such location given. The general run of transmission lines will be determined, with arrangements for lines radiating through rural districts."

R. F. Schuchardt, Chicago, is chairman of the committee, of which the other members are: From Wisconsin, Prof. Daniel W. Mead, P. D. Kline and G. G. Post; from Michigan, L. B. Andrus, J. C. Parker and B. E. Morrow; from Illinois, J. P. Clayton, G. W. Hamilton, J. L. Hecht, E. S. Hight and R. B. MacDonald; from Indiana, W. D. Carr and E. G. Ralston; from Minnesota, S. B. Hood; from Iowa, C. A. Sears, and from Kentucky, L. S. Strong. H. H. Field, Chicago, is engineer-secretary.

Pulverized-Fuel Regulations Before N. F. P. A.

No action on the tentative pulverized-fuel regulations was adopted at the annual meeting of the National Fire Protection Association, held at Chicago May 8-10, other than that the committee on dust explosion hazards agreed to draw up improved specifications which could apply particularly to modern central stations. The committee felt that while the present proposed regulations were well suited for industrial and metallurgical plants, they would, from the standpoint of insurance, place a hardship upon central-station companies now using or installing pulverized-fuel systems. The regulations were printed in the ELECTRICAL WORLD for March 24, page 697. The hazards committee is to prepare a revised code consistent with modern practice to be presented at the next annual meeting of the association.

Nebraska N. E. L. A. Has Successful Meeting

Papers on Public Relation Policies, Rural-Line Specifications, Electrical Merchandising and Municipal Ownership Are Well Received—Service at Cost Frowned Upon

IN A STIRRING plea for better relations with the public, George A. Lee, Omaha, presented the story of the utilities' growth before the nineteenth annual convention of the Nebraska Section, N. E. L. A., at Omaha on May 10 and 11. Mr. Lee pointed out three direct results of the movement for improved policies—first, the comparatively few rate cases now up for settlement; second, a deeper appreciation by company managers of the wisdom of friendly relations, and third, the growth of better feeling toward the utilities. Quoting from a Supreme Court decision which held that rate questions were now judicial and not legislative, he declared that such a sentiment was a direct face-about from the feeling ten years ago, when rulings were sometimes upheld regardless of their confiscatory features. Mr. Lee urged strongly that utility managers should go directly to their customers and present their story. Although newspaper publicity served well, he felt that a speaker out on the firing line explaining utility problems was the best mouthpiece.

O. J. Shaw, Lincoln, told of the work of the Nebraska Public Utility Information Bureau, which is printing weekly a thousand circulars for distribution throughout the state.

RURAL LINE PROCEDURE

John C. Hoge, Grand Island, in his report on rural lines listed nine factors affecting rural practices in Nebraska. Specifications adopted in other states had been largely followed, but provision had been made for farmers who prefer to build their own lines so that a better rate can be given them. Mr. Hoge advocated a high grade of construction despite initial high cost.

F. H. Brooks, Omaha, spoke of educating the farmer to the value of electrical service as the first step in selling the energy. To indicate the growth of the rural load T. H. Fritts, Grand Island, said that in January, 1922, there were 6,417 farm lighting plants in Nebraska, while in January, 1923, this number had risen to 7,978. Since rural-line distribution losses practically equal the energy consumption, the development of more day load was strongly advocated by other speakers.

Speaking on utility service at cost, Prof. V. L. Holister, State University Engineering College, outlined three possible roads for future regulation in Nebraska—first, the present competitive status with home rule; second, state regulation; third, profit-sharing co-operation between the local utility and the community. The consensus of opinion of the convention seemed to be that "service at cost" as applied was a misnomer and that regulation by the state was the best plan of the three. K. R. MacKinnon, Omaha, explaining the power costs of the Hydro-Electric Power Commission of Ontario, said that the Canadians did not want rates based on service at cost but on the value of the service rendered.

The report of the accident prevention committee was presented by W. O. Dunn, Nebraska City, who favored instructing utility operators through their foremen and also advocated that instruction in the prevention of accidents be given in the public schools.

SELLING ELECTRICAL MERCHANDISE

Electrical merchandising was discussed by T. E. Roach, Omaha, who explained the system used by the Union Power & Light Company. He insisted that by the proper merchandising methods no central-station company need handle appliance business at a loss. Mr. Roach has increased his average residential consumer energy consumption to 24 kw.-hr. per month with a merchandising net profit last year of 10 per cent. J. E. Davidson, Omaha, attributed success in raising his company's income per residential consumer from $16 in 1919 to $25 in 1922 to intensive merchandising and the growing popularity of the high-wattage gas-filled lamps. Regarding the necessary reserve needed to be posted against bad debts, Mr. Davidson felt that in cities where the personal equation did not enter strongly 5 per cent was none too large.

On Friday morning C. H. Talmadge, St. Louis, presented the jobbers side of merchandising. A. J. Cole, Omaha, maintained that most utility operators had "gone to seed" on merchandising, whereas this should be their most active field. F. H. Brooks and J. E. Davidson favored the policy of the central station pioneering the sale of appliances through its own organization and not letting outsiders spoil the field for future development.

J. B. Hill, Lincoln, presented a paper on municipal ownership, dealing with its causes and results and the arguments against it. He thought the Legislature should insist that every municipal plant stand on its own feet, paying all the legitimate expenses required of privately owned plants, including state and local taxes.

A report on inductive co-ordination was read by A. J. Cole dealing with the year's work of the committee.

The annual banquet was given Thursday evening at the Hotel Fontenelle, when there was a gathering of jobbers, merchants and utility men.

H. G. Taylor, chairman of the Nebraska State Railway Commission, spoke of the relation between the utilities and the commission and urged that special attention be devoted to the rural-line problem. J. E. Davidson presented the romantic side of the story of electricity and pleaded that more of this phase of the industry be put before the public. A. J. Cole, G. W. Johnstone and John L. Kennedy also spoke.

The following officers were elected: President, T. H. Fritts, Grand Island; vice-president, A. J. Cole, Omaha; secretary and treasurer, Horace M. Davis, Lincoln. The members of the executive committee will be W. B. Roberts of Omaha, G. K. Pittinger of Albion, O. J. Shaw of Lincoln, G. A. Lee of Omaha and J. E. Davidson of Omaha.

St. Louis Is Opposed to Union Electric's Expansion Plan

Opposition to the plan of the Union Electric Light & Power Company to expend $2,000,000 in the purchase of three groups of small power plants in Missouri has been manifested by the municipal government of St. Louis, which, in a petition to the Public Service Commission against granting the company the permission it seeks, expresses the view that if the company's surplus is not needed by it in the conduct of its St. Louis business, electric rates should be reduced to a figure which will not produce such a large surplus.

In connection with the proposal, the North American Company says:

"The Light & Development Company was acquired not only for the purpose of removing existing competitive situations in the interest of continuing the best possible service at the lowest rates, but also with the view of effecting operating economies under large scale production and distribution of electric power by combination of the Missouri properties with those of the Union Electric Light & Power Company. It is in furtherance of this plan that the Union Electric Light & Power Company has applied to the Public Service Commission of Missouri for authority to take over, at the cost to the North American Company's interests, all Missouri subsidiaries of the Light & Development Company."

United Gas & Electric Corporation Readjustment

The stockholders' readjustment committee of the United Gas & Electric Corporation, which controls electric light and power companies and other public utilities in Pennsylvania, New York and several other states and which suffered a large impairment in capital account through the foreclosure of mortgages held against the International Traction Company and the American Cities Company, has proposed to its stockholders a plan of readjustment by which a consolidation with the Berkshire Corporation, recently organized in Connecticut to acquire three electrical properties in Lancaster County, Pa., where the United Gas & Electric Corporation also has subsidiaries, is effected. If the plan is approved by the stockholders, the consolidated corporation will issue its preferred stock (of the par value of $100 a share) and its common stock (of the par value of $10 a share) in exchange for the first preferred stock of the corporation on the basis of seven shares of preferred and seven shares of common stock of the consolidated corporation for ten shares of first preferred stock of the corporation.

The total authorized capital stock of the consolidated corporation will be $9,000,000, of which $6,499,360 will consist of preferred stock and $2,500,640 of common stock.

Great Falls of Potomac and Cacapon River Projects

Since two years have passed during which the United States Congress has taken no action on the development of power at the Great Falls of the Potomac, the priority granted by the water-power act has expired. For that reason the Federal Power Commission has announced formally that it is particularly desirous of receiving applications for the development of the Great Falls project.

An application for a preliminary permit covering this development has been made by Stinemann & Quick of Baltimore, but these applicants have not convinced the commission of their ability to finance such a large undertaking. It is believed, however, that action will be taken on this application in the near future if no applications are forthcoming from interests considered better qualified to make the development.

The project of the Cacapon Power Company on the Cacapon River, near Martinsburg, W. Va., has been found to come within the jurisdiction of the Federal Power Commission. The project involves the erection of a dam 175 ft. in height, which will provide 150,000 acre-feet of live storage.

The interests behind the Cacapon Power Company are the same as those behind the Cheat River development. This Cacapon storage will be of great value in taking care of the peak loads. This is one of the free storage sites relied upon by Major Max Tyler in his plan for the development of the Great Falls of the Potomac.

U. S. Chamber of Commerce for State Utility Regulation

The eleventh annual convention of the United States Chamber of Commerce, held at New York City last week, passed forward-looking resolutions on the regulation of public utilities, international economic policy, immigration, transportation, the merchant marine, federal taxation, waterways, the coal industry and a number of other subjects. On public utility regulation it declared for state as against municipal regulation.

Julius H. Barnes of New York was re-elected president of the chamber, and Elliot H. Goodwin, Washington, resident vice-president. Four regional vice-presidents were elected in accordance with the new plan of dividing the country into four districts with headquarters in each. They were as follows: A. C. Bedford of New York for the Eastern States, Thomas C. Wilson of Chicago for the North Central States, Harry A. Black of Galveston for the Southern Central States, and H. M. Robinson of Los Angeles for the Western States.

National Manufacturers Draft Comprehensive Platform

Meeting in New York City this week for its annual convention, the National Association of Manufacturers, representing fifteen industrial states, adopted tentatively a preliminary draft of a platform which will be recommended to both the leading political parties for adoption in the presidential campaign next year. This platform, which will be amplified and put in definitive shape next month by a committee including three members from each industrial state, is comprehensive, covering government and industry, taxation, transportation, immigration, the merchant marine, coal mining, foreign trade and other issues.

The repeal of the excess-profits tax and the imposition of a tax on gross final sales are favored, as are permissive consolidation of existing railroad systems where this will promote efficiency and the encouragement of foreign trade by a tariff policy framed in the light of present-day commercial conditions and a scientific revision of taxation laws. Government ownership in any form is strongly opposed.

Silk-Mill Lighting

Illuminating Engineers Discuss Applications of Mercury-Vapor and Tungsten-Filament Lamps

RECENT applications of mercury-vapor and tungsten-filament lamps to silk-mill illumination were discussed before a well-attended meeting of the New York Section of the Illuminating Engineering Society at Paterson, N. J., on May 11. Two papers were presented, "Silk-Mill Illumination with Mercury-Vapor Lamps," by C. F. Strebig of the Cooper Hewitt Electric Company, and "Lighting the Silk Industry with 'Mazda' Lamps," by H. W. Desaix of the Watson-Flagg Engineering Company. Before the meeting members and guests were taken through the National Silk Throwing Company, where an interesting example of mercury-vapor lighting was inspected.

High visual acuity, low intrinsic brilliancy and high diffusion are the features of the mercury-vapor lamp, declared Mr. Strebig, whose paper was presented by W. J. Winninghoss. He went on to point out that fine details which can be discerned only with difficulty under continuous-spectra light are readily distinguishable under the simple light of the mercury-vapor lamp. Actual installations of the mercury-vapor lamp in the winding, spinning, warping and weaving rooms were described.

Requirements to Be Met

Mr. Desaix's paper was in the nature of a report of an investigation. It was pointed out that a satisfactory system of lighting must meet the following requirements: Higher intensity on the looms than over the drives and aisles, adequate intensity for all purposes, freedom from glare both direct and by contrast. The cost of installation and upkeep must be reasonable in comparison with results and must pay a return on the investment. For winding and quilling, "RLM" steel-dome reflectors with 200-watt "Mazda C" lamps spaced on 12-ft. centers and 12 ft. high will give a general illumination of about 8 foot-candles, the speaker said—an intensity sufficiently high for ordinary purposes. In warping rooms where horizontal warpers are used each warper should be treated as an individual unit, using the "spilled" lighting principle. The luminaires should be placed over the creel, over the reed and over the beam, all centered over the width of the machine and using the lamps named above. The intensity in this case will be about 30 foot-candles on the work. In the throwing process good results will be secured by using "RLM" steel-dome reflectors with 200-watt enameled-bowl lamps spaced on centers of 16 ft. to 18 ft. and hung 12 ft. to 14 ft. from the floor. This will provide about 4 or 5 foot-candles. For dyeing rooms a prismatic-glass vapor-proof reflector globe using a 150-watt type "C" clear "Mazda" lamp was recommended. The units should be spaced in bays 10 ft. x 10 ft. and mounted 10 ft. from the floor. The illumination in this case will be about 12 foot-candles.

First Divisional Meeting of Contractors' Society

The first of the divisional conventions to be undertaken by President James R. Strong and Director Laurence W. Davis of the Association of Electragists International is to take place at Pittsfield, Mass., on Thursday, June 14. This will be an Eastern Division meeting, including the New England States, New York, New Jersey, Pennsylvania, Delaware, Maryland and the District of Columbia. The Hotel Maplewood will be headquarters.

The morning session will be devoted to meetings of the New York State Association of Electrical Contractors and Dealers. Chairman F. A. Mott will preside. At 2 o'clock the first session of the divisional convention will begin. President Strong's address will be followed by a speech on "Selling Electrical Service," by Charles L. Edgar, president Edison Electric Illuminating Company of Boston. "Service After the Sale" is the title of a talk to be given by Miss Alice Carroll of the Society for Electrical Development. Charles L. Eidlitz, New York commissioner, will speak on "Back to Quality, Sane Costs and Fair Dealing." "Estimating and Selling the Job" will be the topic of Laurence W. Davis, director of promotion and development of the association.

Missouri Convention to Be Held Afloat

Electrical transmission problems in Missouri and the adaptation of oil engines for small central stations will be the subjects of papers to be presented at the seventeenth annual convention of the Missouri Association of Public Utilities, to be held on board the Steamer Harry G. Drees on May 24-26. This steamer will leave at the foot of Market Street, St. Louis, at 8 p. m. Wednesday, May 23, for a trip to Peoria, Ill., and back, with a stopover at Quiver Beach on Friday, when a picnic will be held. The tentative program is in part as follows:

THURSDAY, MAY 24

Morning.—Presidential address, E. R. Locke; Public Utility Information Bureau report, W. H. Henby; address, "Comparison of the Public Utility Industry for the Years 1915 and 1921," J. B. Sheridan, manager Missouri Committee on Public Utility Information.

Afternoon.—Address, Hugh McIndoe, member Missouri Public Service Commission; address, "Application of Oil Engines for Small Central Stations," Stanley Stokes, Union Electric Light & Power Company, St. Louis.

FRIDAY, MAY 25

Morning.—Address, "Public Utility Problems from a Manufacturer's Viewpoint," George A. Hughes, president Edison Electric Appliance Company, Chicago; address, "Some Electrical Transmission Problems in Missouri," L. W. Helmreich and N. C. Mann, Missouri Public Service Commission.

Stone & Webster Men Meet

President of Firm Tells Treasurers that Public Utility Securities Grow More Stable

A FUNDAMENTAL gain in the attitude of the public toward utility questions which tends to increase the stability of the industry has come since the war, Edwin S. Webster, president Stone & Webster, Inc., declared at a convention of resident treasurers representing sixty companies under this management which was held this week at the home offices in Boston. "Up to the time of the great war," said Mr. Webster, "the development of the art had been such that rates in electric light and power companies, gas companies and street-railway companies had had a continuing downward tendency. New methods and increased efficiency in operation had enabled the companies, in spite of increasing basic costs, to give their service at a decreasing cost.

"A short time before the war," he continued, "costs were gradually rising, with the result that many of the companies were in the embarrassing situation of selling their service for a fixed sum, with no provision for taking care of the increased cost of production. At that time it was almost impossible to make the moderate increase in rates necessary, partly on account of the fact that a large proportion of the utilities were owned by a comparatively small number of people, and it was impossible to get the sympathy of the public in general for any such increase. Then came the war with the tremendous increase of cost which made a revision of the public utility rates absolutely necessary. The economic changes at that time were so great that the companies had no difficulty in proving before any fair tribunal the absolute necessity of a revision of rates, and they were able to bring about a clearer appreciation that the development of any locality and the public utility are so closely associated that neither can succeed without the other.

Welcome Change of Attitude

"With this improved understanding of the utility situation by the public in general came an almost unlooked-for advantage. Investors in the localities where the utilities were located began to see that their securities were desirable investments. Companies all over the country have successfully offered stocks, notes and bonds to their customers and to local investors, which has had the most desirable result of getting customers interested in the companies selling them service and has also opened up a new source of capital for extensions."

The convention was the third the organization has held and was presided over by H. B. Sawyer, treasurer of companies under Stone & Webster management. The program included thirteen addresses by resident treasurers from all sections of the country.

Power Board Activities

Rio Grande Project Waits on the State Department—Ambitious Plan for Cheat River

PENDING a report from the State Department, the Federal Power Commission will grant no rights in connection with the project on the Rio Grande near Laredo, Tex., which is intended to export power for public utility use in Mexico. The Mexican authorities are understood to be anxious to have the development proceed.

A preliminary permit has been issued to the West Virginia Power & Transmission Company covering an extensive project for the complete development of the Cheat River in West Virginia and Pennsylvania. The project contemplates the ultimate development of 600,000 hp.

A license is to be issued covering Pit River project No. 3 of the Mount Shasta Power Corporation and a preliminary permit to the same company covering Pit River project No. 4.

A preliminary permit is to be extended by the Federal Power Commission to the Murtaugh Irrigation District covering a project on Snake River near Auger Falls. It is proposed to develop 16,000 hp. to be used in pumping water to two levels where the lift is 92 ft. and 155 ft. respectively. The district to be irrigated is known as the Hansen-Butte project. Engineers express some doubt as to the feasibility of the higher lift and point out that it probably would be to the advantage of all concerned were the power purchased from the public utility company which is operating in that region.

Preliminary permits have been issued to P. B. Cross of San Francisco, covering a small project on Deer Creek in Tehama County, Cal.; to Kehoe, Hanson, Hummel & Sutherland, covering a 200-hp. mining project on Thumb Creek, near Hyder, Alaska, and to Blue & Traversy of Hyder, covering a small project on the Soule Glacier River.

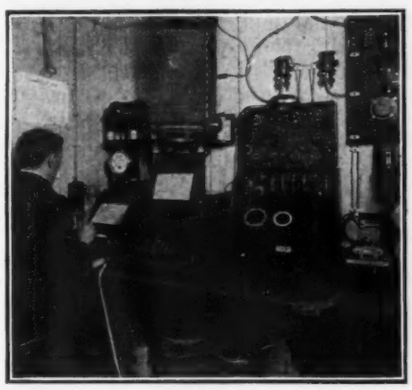
Preliminary permits extended to Maurice D. Leehey and to John H. Hughes have been revoked. In the case of the Hughes permit the provisions prescribed were not carried out. The Leehey permit, which covered an important project at Beaver Falls, near Ketchikan, Alaska, was revoked because the applicant declined to accept the terms under which the Forest Service will sell timber to be used in the manufacture of pulp.

Predicts Reductions in Cost of Making Electricity

General reductions in the cost of the production of electricity were prophesied by C. C. Perry, president of the Indianapolis Light & Heat Company, in addressing the Commercial Section of the Indiana Electric Light Association in Indianapolis on May 3. "The keenest brains in the world are evolving intricate machines which ultimately will reduce the cost of the production of electrical energy to the minimum," declared Mr. Perry. "We must look forward to cheaper rates to the consumer. These machines will enable us to do just that. Although it may take many years, I have little doubt that we are steadily approaching the time when the consumer cannot claim he suffers the brunt of the cost of development."

Brief News Notes

Ocean Steamer Has Two-Way Radio.—On the last voyage of the White Star liner Majestic radio messages were exchanged with shore stations of the Radio Corporation of America at speeds of more than eighty words per minute when the vessel was a thousand miles at sea. In order to effect two-way high-speed telegraphic service on the vessel



it was equipped by the Marconi Company with a high-speed receiver which worked most satisfactorily. High-speed signals were also received from Paris at a distance of 800 miles at a speed of eighty words per minute. The photograph showing part of the radio equipment of the steamer was supplied by the Radio Corporation of America.

San Joaquin Corporation Has Profitable Year.—The San Joaquin Light & Power Corporation, operating in Fresno, Bakersfield, Merced, Taft and vicinity, reports to the California Railroad Commission for the year 1922 that its electric operating revenue was $5,892,578 and electric operating expenses $3,062,172, giving a net electric operating revenue of $2,830,406. The company declared dividends of $766,800 during the year, leaving an accumulated surplus at the end of the year of $2,637,451.

Industrial Teachers' Scholarships.—The State of New York is offering twenty-five industrial teachers' scholarships of $1,000 each to qualified persons who have had at least five years of all-round experience of journeyman grade in one of twelve trade, industrial or technical occupations, including electrical constructing, repairing and operating and electrical drafting and design. Persons selected to hold these scholarships will spend one year at the Buffalo State Normal School preparing to teach their subjects in the public vocational schools of the state. The State Department of Education, Albany, will furnish detailed information.

Survey of Uintah Basin.—A survey of streams in the Uintah basin for the purpose of land classification and determination of power possibilities will be conducted about July 1 under the direction of Ralf R. Woolley, hydraulic engineer of the United States Geological Survey. Dam sites will be mapped, and final results will be included in the standard topographic map of the United States.

Progress of Water-Power Development in Austria.—At the present time about one thousand water-power stations are under way in Austria. In 1921 more water-power stations were under way than the entire country possessed previously. In 1922 ten stations with a combined capacity of 22,610 hp. were put in operation, while on twenty-nine plants with a combined capacity of 205,850 hp. work was continued and eight plants, rated together at 33,030 hp., were started. Altogether this came to forty-seven water-power stations with a combined capacity of 261,490 hp. To this must be added 895 smaller stations. A great saving in coal imports is hoped for when all these projects are completed.

Progress on Wilson Dam.—Work on the Wilson Dam at Muscle Shoals is 40 per cent complete. Progress is following the preliminary estimate closely. In March 34,586 cu.yd. of concrete was put in. Of that amount, 17,293 cu.yd. went into the dam and 17,097 cu.yd. into the power house. The remainder was put in the lock. Reports so far received for work in April indicate that the same rate was maintained. Working conditions throughout the season have been particularly favorable. There has been no trouble with high water, the only delay having been a few days when the rainfall was sufficiently heavy to interfere with work. There have been no troubles in securing labor or materials.

Maplewood, Mo., Opens "White Way."—The city of Maplewood, Mo., a suburb of St. Louis, opened a new "white way" on April 30 with a celebration which lasted for a whole week. This "white way" consists of 150 250-cp. series incandescent lamps mounted on ornamental iron standards placed from 50 ft. to 80 ft. apart on both sides of Manchester Avenue for a distance of three-fourths of a mile. The electric service is supplied by the Western Light & Power Company, and the lights are so arranged that 120 of them burn from dusk to midnight and thirty from dusk to daylight. The Maplewood Merchants' Association contracted for the "white way" for ten years, and the property owners have guaranteed payment of the bills.

Largest and Fastest Cable.—Plans for laying a new cable between New York and London by way of Nova Scotia and the Azores are announced by the Postal Telegraph-Commercial

Cables System. The new cable, contracts for the manufacture of which have already been completed, will be the largest and fastest ever laid in the Atlantic Ocean, President Clarence H. Mackay states. Engineers who designed the cable estimate that its speed will be about 600 letters per minute. The conductor will require an average of about 1,100 lb. copper per mile, as against an average of about 700 lb. per mile in the heaviest cable now in use. It will cost between $10,000,000 and $15,000,000 and is expected to be in place by Aug. 1.

Boston Suburban Utilities Change Rate.—Following protracted hearings before the Massachusetts Department of Public Utilities on petitions brought against the Malden Electric Company and the Suburban Gas & Electric Company, an agreement has been reached whereby the former service charges of these companies will be superseded by a three-part rate in which the first 15 kw.-hr. per month will be billed at 10½ cents net, all energy consumed above this at 8 cents per kilowatt-hour, and a minimum charge will be made ranging from 50 cents net per month for each 15-amp. meter or under to $1 net per month for each 600-amp. meter or over. The service charge under the old rate was 35 cents per month, with a 9-cent energy rate.

Kelso-Wurdack Company Will Take Over Some Services of Light & Development Company.—The Kelso-Wurdack Company, a Missouri corporation with offices in St. Louis, organized to manage, own and operate utility and other companies, will, it is announced, render all services that have been previously performed by the Light & Development Company of St. Louis in connection with the operating, engineering, management and current legal affairs of the following subsidiaries of the United States Public Service Company; Mitchell (S. D.) Power Company, Texas Utilities Company, Slaton (Tex.) Power & Light Company, Monmouth (Ill.) Public Service Company, Paris (Ky.) Gas & Electric Company, Danville (Ky.) Light, Power & Traction Company, and Carlisle (Ky.) Electric Light & Power Company.

Plant to Develop 105,000 Hp. at Oak Grove, Ore.—As plans of the Portland (Ore.) Railway, Light & Power Company develop for the construction of its Oak Grove hydro-electric project, it is foreseen that the ultimate power available will be 105,000 hp., instead of 100,000 hp., as originally figured. The total cost of the development will be $12,000,000, or $2,000,000 more than contemplated. With the approach of summer construction work is progressing rapidly on the first unit, which will develop 25,000 hp. Work is being rushed on a 25-mile extension of railroad in order that material may be transported to the dam and power-house sites. A force of 1,800 men is now engaged on the various phases of the work. It is expected that the first unit will be completed and in operation during the early part of 1924.

Yadkin River Company Acquires Municipal Plants.—The Yadkin River Power Company, a subsidiary of the Carolina Light & Power Company, with home office at Raleigh, N. C., has established service at Dillon, S. C., and has taken over the municipal plant. For several months the company has been engaged in the construction of a transmission line between Maxton, N. C., and Marion, S. C. This line has now been completed as far as Dillon. The municipal plant at Rowland, N. C., has already been taken over by the Yadkin company, and the municipal plant at Latta, S. C., will be acquired as soon as the transmission line is completed to that point.

Rapid Growth of Sheboygan Plant.—Extensive improvements and additions to cost in the neighborhood of $200,000 will be made in Sheboygan, Wis., by the Eastern Wisconsin Electric Company, operator of electric light and power and street-railway properties in that city. This expansion plan covers the purchase of additional ground and the erection of new units in its present steam generating plant which alone will cost about $180,000 and outstrip the capacity of any other steam generating plant in that part of the state. It is estimated by officials of the company that this equipment will be ready for service by Sept. 15. When completed this plant will transmit power clear across the state as far west as Fond du Lac and southwest into Illinois at Galena. The output of the Sheboygan plant for the year ended April 1, 1923, was 24,202,466 kw.-hr., an increase of 545 per cent in ten years.

Associations and Societies

New York Electrical League.—Charles L. Eidlitz, commissioner for the electrical contractors' associations of Greater New York, will address the luncheon of the New York Electrical League at the Hotel Astor on Wednesday, May 23, at 12:30 p.m.

Philadelphia Electrical Contractors' Association.—Application for a charter has been made by this association, of which Charles E. Tull is president and M. G. Sellars secretary. The object of the association is to distribute technical electrical information, promote better trade relationships and advance the standing of electrical merchandise and workmanship.

American Society for Testing Materials.—The twenty-sixth annual meeting of this society will be held on June 25 to June 29, at Chalfonte-Haddon Hall, Atlantic City, N. J., with a very full program of committee reports and papers on tests, fatigue, corrosion, preservatives, magnetic analysis and so forth of various materials. F. M. Farmer, chief engineer Electrical Testing Laboratories, New York City, will report as chairman of the committee on electrical insulating materials, and there will be papers on electrical insulating varnishes, electrical slate and other topics of interest to the electrical industry.

Public Utilities Advertising Association.—This association, organized last fall, will hold its first session in connection with the annual convention of the Associated Advertising Clubs of the World at Atlantic City, June 3 to 7. The Public Utilities Advertising Association, which is rapidly growing, includes representatives of electric light and power, electric railway, gas and telephone companies in its membership. The sessions at Atlantic City will be devoted to public relations and utility advertising. On June 5 there will be addresses by J. C. McQuiston, manager publicity department Westinghouse Electric & Manufacturing Company, on "Why Advertise?" by Francis H. Sisson, vice-president Guaranty Trust Company, New York, on "Public Utilities and Public Relations," and by W. H. Hodge, manager advertising department, Byllesby Engineering & Management Corporation, Chicago, on "Customer Ownership Advertising."

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

Electrical Supply Jobbers' Association—Executive committee and general meeting, Hot Springs, Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

Missouri Association of Public Utilities—River boat from St. Louis to Peoria, May 24-26.

American Society of Mechanical Engineers—Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.

Westinghouse Agent-Jobbers' Association—Hot Springs, Va., May 28-June 2.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

California State Association of Electrical Contractors and Dealers—Dorner Lake, Cal., June 9-16.

Electric Power Club—Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

North Central Division, N. E. L. A.—Minneapolis, June 20-22. H. E. Young, Minneapolis General Electric Company.

Society for the Promotion of Engineering Education—Ithaca, N. Y., June 20-22. F. L. Bishop, University of Pittsburgh.

Canadian Electrical Association—Montreal, June 20-23. Louis Kon, 65 McGill College Ave., Montreal.

American Institute of Electrical Engineers—Annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

American Society for Testing Materials—Atlantic City, June 25-29.

Iowa Section, N. E. L. A.—Mason City, June 26-29.

Associated Manufacturers of Electrical Supplies—New London, Conn., June 26-29. Frederic Nicholas, 30 East 42d St., New York.

National Council Lighting Fixture Manufacturers—Buffalo, June 26-28. C. H. Hofrichter, 233 Gordon Square Bldg., Cleveland.

Northwest Electric Light and Power Association—Seattle, June 27-30. G. E. Quinan, 204 Electric Bldg., Seattle.

Ohio Electric Light Association—Cedar Point, July 10-13. D. L. Gaskill, Greenville.

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 6-8. Miss O. A. Bursiel, 149 Tremont St., Boston.

Association of Iron and Steel Electrical Engineers—Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

Recent Court Decisions

Telephone Company Permitted to Recover from Light Company Sum Paid Under Workmen's Compensation Act.—The Appellate Court of Indiana has sustained a verdict permitting the Home Telephone Company to recover from the Wabash Water & Light Company sums paid and to be paid by the telephone company under the workmen's compensation act because of the death from electric shock of a lineman in its employ. The lineman while working on the telephone wires came into contact with a 2,300-volt wire maintained on the same pole by the electric service company and was killed. The telephone company, claiming that the wire with which the lineman came into contact was insufficiently insulated, sued to recover the amount it was legally bound to pay the victim's heirs, charging the defendant company with negligence. (138 N. E. 692.)*

Kansas Court Affirms One-Dollar Service Charge.—A service charge of $1 a month made for gas by the Leavenworth (Kan.) Light, Heat & Power Company was overruled as excessive by the Kansas Public Utilities Commission and a charge of 55 cents substituted. A temporary injunction against the enforcement of the reduction was obtained by the company, a fund being established by it for the reimbursement of its customers should the final decision sustain the commission. The Kansas Circuit Court of Appeals has sustained the company's contention that a charge of less than $1 would be non-compensatory as failing to cover the cost of installation and repairs of piping and meter, keeping accounts, rendering bills and the other items independent of general operating and maintenance expense.

Damage to Land by Seepage from Reservoir Question for Jury.—In Bijou Irrigation District vs. Cateran Land & Live Stock Company, an action to recover for damages to land caused by seepage from defendant's reservoir, the Supreme Court of Colorado held that where engineer witnesses for both sides testified that the source of some of the water on plaintiff's land was defendant's reservoir the question of damages was for the jury. The court found that it was improper to plead that damages were caused by high water in the river, heavy rains and seepage from a ditch other than defendant's, because such matters were merely evidential tending to show that the damage to plaintiff's land was not due to percolation or seepage from defendant's reservoir and so to support defendant's denials. Quotation of this plea was not, however, prejudicial where the court in addition stated the denials on which the defendant relied. Evidence that damages to plaintiff's land could have been averted by drainage was improperly stricken out on the ground that feasibility of drainage had not been pleaded, since the evidence went to negative the amount of damages, was not in confession and avoidance, and it would have been improper to plead it because it was mere evidence. Judgment for the plaintiff was reversed and a new trial ordered. (213 Pac. 999.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Revaluation Figure for Alabama Power Company Placed at $29,000,000.—The revaluation case of the Alabama Power Company (see ELECTRICAL WORLD, May 5, page 1057) has resulted in the Public Service Commission of that state establishing the value of the company's properties for rate-making purposes at $29,000,000, a reduction of $4,843,252 from the valuation of $33,843,252 placed by B. H. Cooper and S. P. Gaillard, associate commissioners, shortly before they retired from office. In reaching the new valuation the commission considered the evidence submitted in the original hearing and made new investigations into the various phases of the case. The valuation covers all property of the company as of June 30, 1920, the date involved in the original proceeding. To this value was added that of property acquired since that time, including the utilities of Montgomery, the utilities at Selma, the development at Mitchell Dam and other small plants. The new valuation is about $15,000,000 less than the final valuation placed by Hagenah & Erickson, engineers, who made an inventory and appraisal of the property for the commission after the valuation case was docketed in 1920. Hagenah & Erickson's original report placed the valuation at approximately $47,000,000, but conferences between them and I. F. McDonnell, engineer for the commission, caused a reduction of the valuation to approximately $44,000,444. Mr. McDonnell made a check of the valuation recommended by Hagenah & Erickson and of the valuation of Morris Knowles, who was employed by large consumers of power, and his recommendation to the commission was the establishment of the valuation at $29,000 000. Up to this time Mr. McDonnell had never made a recommendation, according to members of the commission. The total valuation includes $1,500,000 as working capital and $3,750,000 as going-concern value. Before the valuation can become final sixty days must elapse, and during these sixty days any citizen of Alabama may, under a law passed by the last Legislature, protest against the tentative valuation and may appear before the commission for the purpose of showing why the valuation should not become final. If no protest is filed within the sixty days, the tentative valuation will become final for rate-making purposes.

Sale by Merged Corporation.—A public utility company created by a merger is not authorized by the Pennsylvania statutes to sell and transfer to another company rights, franchises and privileges in the territory of the merged corporation which were formerly vested in a constituent company, according to a decision of the Pennsylvania Public Service Commission *in re* Topton Electric Light & Power Company.

Bills for Separate Installations of Same Customer Must Not Be Added and Discounted.—The Illinois Commerce Commission has overruled a rider in a rate schedule (*re* Produce Terminal Corporation) which provided that if any consumer owns several places of business in different locations and shall use electricity furnished by the company exclusively in all his places of business, he shall be entitled to a discount of 5 per cent from the total of the net monthly bills where two premises only are served and an additional 1 per cent for each additional place of business covered by the contract, the total discount not to exceed 20 per cent. Such a contract, the commission insists, is discriminatory, as for all practical purposes installations of the same customer in different localities are the same as installations of separate and individual customers.

Going-Concern Value Should Be Shared with Public.—The Public Utilities Commission of Connecticut in arriving at a valuation of the Ansonia Water Company made the following observations concerning going-concern value: "In determining the value of private property, such as mercantile or manufacturing establishments, the actual market value, what a willing or even anxious purchaser would be willing to pay, is an important factor and necessarily takes into consideration good will or going value of a successful business; but if market value should be considered as the measure of fair value of a utility company, upon which to base a return, many utility companies in operation today would be deprived of a fair return on the actual investment. Where a utility property is valued on the basis of cost to reproduce new, less depreciation, and the items of organization expenses, interest and taxes during construction, etc., are taken into consideration and included, and the subsequent business development cost charged to operating expenses, the intangible items of 'going value' or 'good will' should not then, in our opinion, be arbitrarily added as elements of value. . . . Whatever the intangible value of this element may be, it should, to some extent, accrue to the benefit of the public which assisted in creating it as well as to the company in increased volume of business."

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

Dr. B. B. Brackett Leaves State College

Dr. B. B. Brackett, who has been the head of the electrical engineering department at South Dakota State College for the past fourteen years, has resigned from the faculty to become head of the electrical engineering department at the University of South Dakota. Before going to South Dakota Dr. Brackett was for some time private assistant at Johns Hopkins University to Prof. Henry W. Rowland, recognized as one of the greatest physicists America has ever produced. He also held chairs of electrical engineering at the Clarkson Institute of Technology at Potsdam, N. Y., and at Rutgers College. Heretofore Dr. L. E. Akeley has not only acted as dean of the College of Engineering of the University of South Dakota but has also performed the duties of professor of physics and electrical engineering. The need of assistance in his work has been apparent, and with the addition of Dr. Brackett to the faculty he will be relieved of the work in electrical engineering and enabled to give his entire time to his other duties.

Harold F. Eastman, who has been associated with the Connecticut Power Company, a Stone & Webster property, has been transferred to Boston in the division of construction and engineering.

L. P. Perry, vice-president and treasurer of the Central Connecticut Power & Light Company, has joined the organization of the Central Hudson Gas & Electric Company, with headquarters at Poughkeepsie, N. Y.

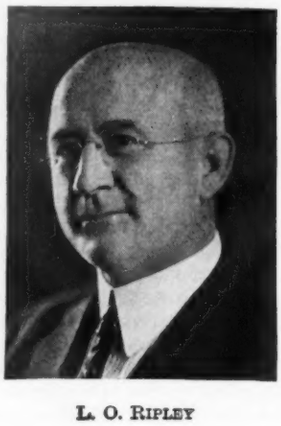
Wilfred G. Parkinson of the Carnegie Institution of Washington sailed on May 3 for Santa Teresa en route to Huancayo, Peru, where the institution has an observatory in which changes in the earth's magnetism and variations of atmospheric electricity are watched.

John E. Loiseau, for eight years secretary-treasurer of the Montgomery (Ala.) Light & Water Power Company, has been appointed secretary of the Denver Gas & Electric Light Company. Mr. Loiseau's appointment fills the vacancy created when Clare N. Stannard was promoted to the vice-presidency and general managership upon the death of William J. Barker.

C. E. Oakes, an electrical engineer who has been in the service of the Federal Power Commission, has resigned to accept a position with the Pennsylvania Power & Light Company. The vacancy created by his resignation has been filled by the appointment of N. B. Keeler. Mr. Keeler for many years has been an assistant engineer of the Corps of Engineers of the army. It was he who made a recent inventory for the Federal Power Commission of the properties of the Niagara Falls Power Company.

L. O. Ripley Heads Middle West Division of N. E. L. A.

L. O. Ripley, vice-president of the Kansas Gas & Electric Company, was recently elected president of the Middle West Division of the National Electric Light Association. Mr. Ripley, though a native of New York, has been in Kansas since 1909, when he became associated with the American Power & Light Company and was immediately sent West as the field executive of the Kansas Gas & Electric Company, which is controlled by the American Power & Light Company. He entered the electrical industry during his high-school years, when he worked in the electric light plant at Cooperstown, N. Y., in the early mornings and afternoons. Following his graduation in 1900, from Union College, Schenectady, as an electrical engineer, he engaged in outside construction work until 1903, when he returned to Schenectady and joined the Schenectady Railway Company, which at that time also operated the electric light and power business as well as the gas business in Schenectady. This property was directly affiliated with the General Electric Company. Mr. Ripley was made superintendent of light and power, which included the interurban and city railway systems as well as light and power distribution in the city. When the railway systems were sold he became manager of the Schenectady Illuminating Company and remained there until he allied himself with the American Power & Light Company. Mr. Ripley has been an important factor in utility development in Kansas, both as an executive of the light and power company with which he is associated and as an active participator in the organization and work of the division of the National Electric Light Association which he is now called upon to head.



L. O. RIPLEY

T. C. Martin is now secretary of the New York Electrical Society, succeeding the late George H. Guy.

Charles W. Tippy of Jackson, Mich., general manager of the Consumers' Power Company, was recently elected president of the Great Lakes Geographical division of the National Electric Light Association. He succeeds Harry Reid of Indianapolis.

Howard T. Spaulding, who has been associated with the Nela Park laboratories at Cleveland for the past fourteen years, has been appointed illuminating engineer for the Bryan-Marsh Lamp Division with headquarters in Boston.

T. S. Saylor, formerly of the appliance department of the Salem (Mass.) Electric Lighting Company, has been appointed sales manager of the Rockland Light & Power Company, Nyack, N. Y., and of the Rockland Electric Company, Ramsey, N. J.

L. F. Wiegand, formerly executive in charge of the investment department of the Iowa Railway & Light Company, Cedar Rapids, has been appointed assistant vice-president in charge of investments of the Central Indiana Power Company, Indianapolis, and the Indiana Electric Corporation, which is controlled by the Central Indiana Power Company.

Col. Eugene J. Spencer, secretary of the St. Louis Electrical Board of Trade, was officially presented with the distinguished service medal, which was awarded to him about a month ago, by Major-General George B. Duncan, commander of the Seventh Corps area, at ceremonies held at Jefferson Barracks on Friday afternoon, May 11. Colonel Spencer received his award for "meritorious and distinguished services" while in command of the Engineer Corps in the southern area of France in 1918.

E. J. Steinberg, resident engineer in Milwaukee for the Wisconsin Railroad Commission for the past ten years, will resign June 1 to ally himself with the Milwaukee Electric Railway & Light Company. Mr. Steinberg joined the commission engineering force in 1910. Three years later he was transferred from Madison to Milwaukee as resident engineer. Since then he has had charge of street-car schedules for the Milwaukee Electric Railway & Light Company and has performed other administrative and regulatory duties, involving public utility properties in the Milwaukee district.

Edgar M. Blessing and **Glenn Vanauken** have been reappointed for four-year terms on the Indiana Public Service Commission.

E. C. Davis, formerly with the merchandising division of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa., is now in the Los Angeles office of that company.

Thomas F. McDonough is now in charge of the Northwest territory of the Benjamin Electric Manufacturing Company. He will have supervision over the States of Montana, Idaho, Washington and Oregon.

James W. Armour has been appointed assistant general superintendent of the Murphy Iron Works plant of the Sanford Riley Stoker Company, at Detroit. Mr. Armour entered the plant in 1919 as inspector and later became production manager.

E. L. Doty, district service manager of the Buffalo branch office of the Westinghouse Electric & Manufacturing Company, has been appointed engineering assistant in the service department, with headquarters at East Pittsburgh. J. A. Atkinson has been appointed Buffalo service manager.

Maurice Metcalf of New York has been elected treasurer of the American Bosch Magneto Corporation of Springfield, Mass., and will soon assume the duties of the office. Mr. Metcalf succeeds George A. MacDonald of Springfield, who continues as a director and vice-president of the corporation.

George F. Murphy, formerly manager of the Pittsburgh office of the Heine Boiler Company, St. Louis, has been placed in charge of the New York territory of the company upon the retirement of Paul H. Brangs, who had been for many years in charge of the local office. Mr. Murphy will be assisted by J. L. Daly and G. A. Knowles.

Rodney Q. Selby of Des Moines has been appointed assistant director of the Iowa Committee on Public Utility Information. Mr. Selby goes to this committee from the Des Moines *Capital*, with which he has been associated for a number of years. He is a graduate of Drake University and has had many years' experience in the newspaper business.

George Baily, supervisor of distributing agents of the Westinghouse Electric & Manufacturing Company, has been elected president of the Varney Electrical Supply Company of Indianapolis, Ind. Mr. Baily became associated with the Westinghouse Electric & Manufacturing Company in 1914 as manager of the supply division of the Cincinnati office, where he remained until 1917, when he joined the Engineer Officers' Training Camp. On being mustered out of the military service in 1918 Major Baily returned to the Cincinnati office. In 1920 he was made assistant to the manager of the supply department and was transferred to the East Pittsburgh offices of the company. In 1922, when the merchandising department of the Westinghouse company was organized and the supply department reorganized, he was promoted to be supervisor of distributing agents, which position he held until his present appointment.

Obituary

John M. Egan, formerly president of the Metropolitan Street Railway of Kansas City and the Kansas City Light & Power Company, dropped dead at Amboy, Ill., on May 9. He was seventy-five years of age and was born in Springfield, Mass. Mr. Egan retired from the presidency of the Kansas City companies in 1916.

Prof. Louis Derr of the Massachusetts Institute of Technology, Cambridge, died at Brookline, Mass., May 10, after a few weeks' illness. Professor Derr was well known in New England electrical engineering circles for his work in physics and photography. He was born in 1868 at Pottsville, Pa., and was educated at Amherst College and the Massachusetts Institute, becoming professor of physics at the latter in 1909. At the time of his death he was professor of applied optics and photography.

William Shreeve Doran, president of the Alberger Pump & Condenser Company and of Charles Cory & Son, Inc., New York, died on Saturday, May 12. Mr. Doran was born in Philadelphia and obtained his early training with the Southwark Foundry & Machine Company, in that city, and the United Gas Improvement Company. In 1887 he entered the employ of Henry R. Worthington and in 1900 became affiliated with the British Westinghouse interests in establishing their branch offices and supervising sales. He severed his connection with the Westinghouse company to join the Allis-Chalmers company as manager of the power department. Since 1905 he had been with the Alberger company, first in its sales department, later as vice-president and general manager and since 1918 as president. In 1920 he was elected president of Charles Cory & Son, Inc.

Henry Woodland, secretary and treasurer of the Allis-Chalmers Manufacturing Company and a widely known Milwaukee business man, died suddenly early on May 14. When the Gates Iron Works of Chicago was consolidated with the Allis-Chalmers Manufacturing Company, in 1901, Mr. Woodland, who was then treasurer of the Gates company, became assistant treasurer of the Allis-Chalmers company. Mr. Woodland went to Milwaukee in 1904, when the general offices of the Allis-Chalmers company were transferred there. Soon after he was made treasurer of the company and in 1916 was elected secretary and treasurer. He was also vice-president and a director of the Hanna Engineering Company, Chicago.

Paul Preston Haynes, a member of the Public Service Commission of Indiana under the Goodrich administration and since then an attorney specializing in utility matters in Indianapolis, died May 9 at Boston, after a brief illness, at the age of thirty-five. Mr. Haynes completed a two-year term on the commission and then was reappointed for another term by Governor Goodrich, but he resigned in March, 1921, after three years' service. Besides his work on the commission he was a member of the special war committee of the National Association of Utility Commissioners, which dealt with many important questions of railroad and utility regulation during the war.

Rex C. Starr, a prominent Pacific Coast engineer, was found dead on May 3 in a canal of the Merced (Cal.) Irrigation District. Mr. Starr was chief engineer and executive head of the Merced Irrigation District, a member of the firm of Thebo, Starr & Anderton consulting engineers of San Francisco, and consulting engineer for the San Joaquin Light & Power Corporation. Mr. Starr had been connected with many important power developments on the Pacific Coast during recent years. He was resident engineer for Stone & Webster on the construction of the Snoqualmie Falls plant of the Puget Sound Power & Light Company and later on the White River plant of the same company. He was assistant engineer on the construction of the Big Creek development of the Pacific Light & Power Corporation and chief engineer on the Kerckhoff and Kern River projects of the San Joaquin Light & Power Corporation. When he became associated with the Merced Irrigation District a year ago he was retained as consulting engineer by the San Joaquin Light & Power Corporation. Mr. Starr was thirty-eight years of age.

Prof. Arthur Gordon Webster of Clark University, an eminent physicist, died from self-inflicted bullet wounds on May 15. This tragic occurrence, which means a great loss to science, caused amazement among Professor Webster's friends and associates, for he had shown no signs of depression and must, it is believed, have taken his life as the result of a sudden impulse. He had attained great success in many scientific lines and was recognized as one of the world's greatest authorities on electricity and sound. He was born in Brookline, Mass., was graduated from Harvard in 1885 and later studied in Paris, Berlin and Stockholm. After spending a year as instructor at Harvard, he entered the service of Clark University, where he was successively docent in physics, assistant professor of physics, professor of physics and director of the physical laboratory, holding the last-named offices at the time of his death. Professor Webster was the author of several important works on electricity and dynamics and during the war was made a member of the Naval Advisory Board of Scientists, of which Thomas A. Edison was chairman. All who knew him will mourn the loss of a steadfast friend and a delightful personality, and the electrical industry will sadly miss the fruits of his brain and the enthusiasm he inspired for scientific research.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

The Reduction of the Jobbing Line

The Position of the Manufacturer Toward Elimination of Excess Varieties—What the Jobber Can and Should Do to Help the Situation

By W. I. Bickford
Secretary and Treasurer Iron City Electric Company, Pittsburgh

THE Electrical Supply Jobbers' Association meets next week for its annual summer convention in Hot Springs, Va. One of the chief topics of discussion will be the need for the elimination of excess varieties in the jobbing line. Committees of the association have been studying this problem and will come to the meeting prepared to make definite recommendations for the practical simplification of the different commodity lines. With this in mind these expressions from one of the leading electrical jobbers are of interest.

ALTHOUGH one of the leading manufacturers has "taken the bull by the horns" and taken steps to eliminate the duplicate, slow-moving and obsolete items in the so-called schedule lines of his particular manufacture, there appears to be a lack of initiative on the part of other schedule manufacturers to take similar decisive action. These manufacturers acknowledge that many items now listed can be eliminated with resulting economy to all branches of the industry affected, but there seems to be more or less hesitation on the part of the individual manufacturer to reduce the number of items in his line for fear that he may lose business to competitors who do not take similar action.

A Legal Aspect

It has been suggested that such manufacturers get together and follow the suggestion of the United States Department of Commerce in other lines of industry for the simplification of their line. A study made by individual jobbers of the movement of specified lines in specified territories does not show the national demand for any article now listed. However, studies of sales of the different items by individual manufacturers and the comparison of such studies at a conference of such manufacturers would show beyond question what items now made which may be slow-moving or obsolete could be eliminated.

According to Judge Debevoise, there is a legal question as to whether these manufacturers can agree between themselves to eliminate such items. It would seem that if anything definite is to be accomplished it will be necessary to arrange a conference of the representatives with the authority of the leading schedule manufacturers and, under the proper legal advice, determine the proper course of procedure to accomplish the result desired.

I can recall the time when inclosed fuses were made not only in as many sizes as regards carrying capacity but in almost as many actual sizes and types. In those days before filling an order for inclosed fuses it was almost necessary in the majority of cases to obtain an actual sample of the fuse desired. With the adoption of the National Code standards of fuses, both as to type and dimensional size, the duplication and confusion was greatly reduced, although there is still opportunity for pruning as regards definite carrying capacities for which there is little or no necessary demand. The same condition existed in miniature lamps until the lamp manufacturers greatly reduced the large number of types, based on candlepower, size of bulb and base.

While the so-called schedule lines are the most conspicuous commodity lines in which duplication and obsolescence exist, and therefore the logical ones to start to cut, there are a number of other lines on which the same kind of constructive work can be done. I have in mind outlet boxes and covers, which could be materially reduced as regards the items cataloged, with no ill effects and many advantages to the industry; likewise pole-line hardware, under which come machine bolts, carriage bolts and lag screws, listed in almost innumerable lengths and diameters, with no indication by the manufacturer as to which are standard types and which are more or less special.

How the Jobber Can Help

Although the jobber can only use his influence on the manufacturers who are his main source of supply to work toward the end desired in the elimination of unnecessary items, he can do much in the management of his own business by adopting a policy of not stocking duplicate lines of manufacture. Instead of duplicating the slow-moving or even the fast-moving items of competing manufacturers, he should catalog and stock only the product of one manufacturer that will fulfill the individual requirements of his customers. This should be followed up by the salesmen selling this particular product instead of taking orders for any particular brand which the customer seems to favor.

We have endeavored to follow this policy for a number of years and as a result have been able to maintain a minimum stock and at the same time give improved service for products of this manufacturer on which we specialize. If more jobbers will adopt such a policy, the result will sooner or later be the development of the so-called "super-jobber" and a decreased cost of distribution. This is what all of us who are giving the matter any thought are aiming for.

Some Progress Made

In reviewing our figures for the past ten or twelve years it is gratifying to observe that the effort made in reducing the cost of distribution has not been in vain. Although our items of overhead have increased and our percentage of gross profit has decreased over this period, the average value of the order has increased, with the result that we have at least maintained our own as regards net

margin of profit. In other words, notwithstanding the increased actual cost of distribution, the percentage has decreased rather than increased, so that the jobber has been able to operate on a lower percentage of overhead. Of course, this does not apply during the periods of depression when with decreased volume the percentage of overhead has exceeded the percentage of gross profit.

The size of the jobbing line is a large factor in the situation, however, and presents an immediate practical opportunity to do something that actually affords relief. If one manufacturer can reduce his line, another can. If one jobber can reduce his line, so can his competitor. It all depends on whether or not they are willing to look economic laws in the face and do things that may be temporarily inconvenient, in order to help solve a problem for the entire industry.

An Experience in Export Selling

Success in Disposing of a Specialty Despite Restricted Market Makes Evident the Opportunity for American Electrical Appliances

BY E. A. WIGHT

Export Manager Crescent Washing Machine Company, New Rochelle, N. Y.

WE ARE frank to admit that we are new in the export business. We have been selling our washing machines abroad for only about three years. But we are deeply interested in this field, and if we can continue for the remainder of the year the pace we have established, our export business will be from 10 to 15 per cent of our total yearly sales. Our largest markets are Great Britain, the Scandinavian countries, Australia, France, Spain, Switzerland, Italy and Belgium, in the order named.

AGENTS WILLING TO INVEST

We are selling our own product only, although we are continually on the outlook for hotel and restaurant specialities that we can also handle through our agents. Because of the real effort that must be used to introduce our machines in any foreign market it has been our policy to favor exclusive representation. This we do not grant at once, but we put a company on probation for six or eight months. No concern abroad is going to attempt to handle machines like commercial dishwashers without a real hope for an exclusive agency.

Without exception, our agents have purchased the first machine outright. They have installed it on trial in some important restaurant or hotel in the city in which they live. If the machine should prove satisfactory, the restaurant was to pay for it; otherwise the agent would take it back. Thus you can see he was taking a chance in tying up money on the supposition that we, by our representatives and in our literature, were telling the truth about Crescent dishwashers. We are glad to say that without exception the foreign houses that have taken this chance have been successful in selling not only this first machine but many others.

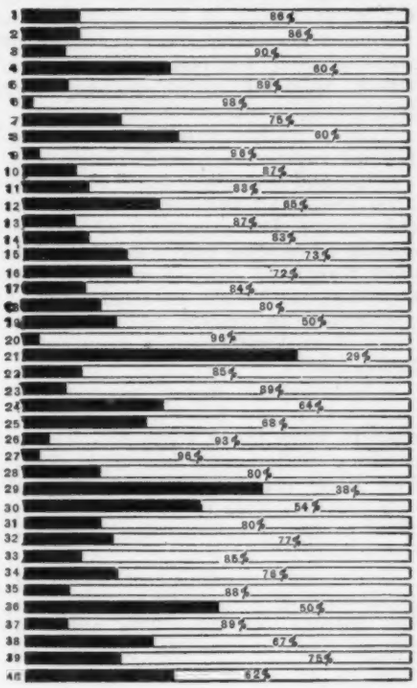
In England we have a condition of "no pressure" to overcome. While every restaurant and hotel that can use a machine has plenty of hot water, nevertheless the pressure is not sufficient to operate the "rinse" —really the most important part of any dishwasher. Therefore, we have had to develop a booster pump for this market. In France the people not only do not have pressure, but there are no hot-water-main supplies there. Even in the biggest restaurants the dishes are washed in sinks, under which gas burners are installed to keep the water hot. There is absolutely no hot-water-main supply, and our agent in that country, in order to sell a dishwasher, has usually to sell to begin with a hot-water system, costing three times as much as the dishwasher. Here again the machine and the entire hot-water system must be put in on trial. This means an outlay of close to $1,000 or more in the case of the larger dishwashers.

In Scandinavian countries the extremely hard water—particularly in Denmark—makes it hard to sell the Crescent against German tank machines. In Australia we no sooner had a good volume of business started than the duty was raised from 35 to 45 per cent ad valorem, and two concerns immediately started copying our larger models bolt for bolt and nut for nut. Our machines had been patented in this country long before we thought of exporting. Therefore, they could not be patented abroad, at any rate in Australia. Such conditions as I have named are typical the world over, and, combined with the relative cheapness of native labor, they necessitate the most up-to-date selling methods on the part of our agents.

BROADENING THE LINE

We feel that we have been extremely fortunate in our selection of distributors. Every one of them is financially sound and pays for machines either by cash in advance or through a letter of credit in New York. Our agent in France, for instance, whenever a customer of his pays him in dollars, immediately forwards the check to us, and as a rule he keeps a substantial credit

Elimination Progress in Industries



Article	Reduction
1. Baskets	78—11
2. Bed springs	206—28
3. Bottles, glass	210—20
4. Bread	15—6
5. Canned goods	200—22
6. Car wheels	175—4
7. Ceramic tile	.....
8. Chain, malleable	2,044—820
9. Cigars	150—6
10. Clocks	600—80
11. Collars	150—25
12. Dry cells	17—6
13. Farm implements	1,092—137
14. Fertilizer	100—17
15. Flashlight batteries	30—8
16. Hammers, axes, etc.	2,752—761
17. Interior tile	735—115
18. Kitchen cabinets	20—4
19. Laboratory apparatus	2,800—1,400
20. Lamp bases	179—6
21. Leather belting	63—45
22. Paper	377—56
23. Paving brick	66—7
24. Pencils	700—250
25. Piano benches	34—11
26. Piano stools	15—1
27. Pipe fittings	17,000—610
28. Pocket knives	1,500—300
29. Reed furniture	400—250
30. Reinforcing bars	24—11
31. Rubber goods	145—29
32. Shafting	60—14
33. Shotgun shells	.....
34. Steel lockers	37—9
35. Stove parts	2,982—364
36. Taps and dies	.....
37. Tires	287—32
38. Toilet goods	425—140
39. Water bottles	20—5
40. Wheelbarrows	42—16

balance here. The fact that we allow an extra 5 per cent discount for payment in New York is, of course, the reason why payment is made in this manner. Five per cent amounts to from $12 to $40 on each machine, so you can see it is well worth the expense of establishing a letter of credit in New York.

Every trade has its own difficulties to overcome, and I have enumerated a few of ours. I believe that we have overcome them, and I am sure that the next two years are going to see a steady increase of orders. Within the next two or three months we are going to start to introduce certain other specialties that we have permission from manufacturers in this country to handle. We did not immediately write to our agents the minute we secured representation for a certain article, but we have held off until our representatives were fully acquainted with and familiar with our own product before asking them to turn their attention to something else. We have wanted them to think and talk nothing but dishwashers for two or three years, without diverting their minds to some other new piece of equipment that they might sell. Now that our machines are fairly well established in various markets, sales resistance will be greatly reduced, and local advertising that we are doing will help to ease the hitherto heavy burden on the distributor.

SPECIALTY HANDICAPPED

I do not believe that we have accomplished anything that has not been accomplished by every American manufacturer who has attempted to build up an export business. I have tried to point out, however, the real difference between our product and domestic electrical appliances and the method that must be used in marketing them both here and abroad. Perhaps one incident will better illustrate this point than further discussion. I have just been reading a trade information bulletin published by the Bureau of Foreign and Domestic Commerce on British India. In this bulletin I note the increased sales of electrical instruments, apparatus, etc., and I find that American sales are increasing in volume and dollar value, which would seem to indicate increasing sales possibilities for all electrical appliances. Yet in all British India there are not twenty "prospects"—even possible purchasers — of Crescent electric dishwashers.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

Eastern Business Shows Little Change Over Last Week

BUSINESS in the Eastern territory shows little change over last week's volume. Prices are firm in current quotations of most commodities, and little scarcity of supplies is reported, barring a temporary uneven stock of rigid conduit. The larger sizes are most difficult to obtain in quantity at present. Jobbers' sales are well distributed among different classes of buyers. Interior wiring is absorbing great quantities of material and appliances are moving freely, sales of socket devices being particularly good.

Transportation conditions are improving rapidly as regards motor-truck service, and the railroad and steamship lines are doing their part to improve shipments. The expansion of central-station generating plants continues the chief feature of interest in utility construction, although a relaxation of regulations in regard to line extensions of moderate cost is apparent in this territory.

A comfortable money market prevails, and recent notes of caution appear to have made some headway in checking inflation tendencies. Some Fall River cotton mills have dropped to a four-day week in production as an offset to recent forced wage increases. Collections are improving.

Conditions in the shoe, metal-working, paper-making and wire factories reflect intense activity. The public is getting restive over the demands of labor in the building trades, and unquestionably much home building is being postponed until more favorable conditions arise.

Evidences of "Easier Buying" in Industries Are Seen

IN CONNECTION with efforts of the electrical industry to avoid inflation of businesses supplying materials for new construction, developments in the building industry indicate that over-ordering of cement, which recently was made the subject of complaint by producers, is being taken up directly between the producers and with good prospects that orders will be pared to actual necessities, according to information received in official circles in Washington. It appears probable therefore that there will be no conference held with federal officials on this subject, as had been suggested at one time there would be.

Evidences of a "buyers' strike" in the construction industry, as reported in newspaper dispatches from various cities where temporary withdrawal of projects has been announced on account of high costs, are being watched closely by Washington officials. While a reasonable let-up in new construction projects would be welcomed as tending to relieve pressure upon material and supply houses and upon the labor supply, there is some fear that the psychological effect may extend to other lines of industry. Conditions in the building industry have been recognized as abnormal, and in considering possible inflation of business this industry has been set aside in a class by itself by government ecoromists.

A general easing of business conditions since the middle of April has been noted in Washington, and it is considered by prominent government officials that the caution now being displayed has averted the possibility of a period of inflation.

Fifty-four Opportunities for Elimination in Electrical Industry

MORE than one thousand outstanding opportunities for the elimination of economic waste through the simplification of varieties and sizes of products are presented in the first analysis of findings in the survey of simplification opportunities which has been carried on during recent months by the American Engineering Standards Committee at the request of Secretary Hoover of the Department of Commerce.

This is in the form of a summary of answers to a questionnaire sent out by the American Society of Mechanical Engineers, one of the member bodies of the A. E. S. C., to selected lists of its membership, which includes all members of its professional division. It shows 54 opportunities among electrical appliances and supplies; 123 suggestions of important standardization opportunities in the automotive and aircraft industries; 115 opportunities in building-material industries; 291 opportunities in tools and other machine-shop equipment; 64 opportunities in paper, catalogs, books and printing; 200 opportunities in boilers, valves, pumps, pipe supplies and kindred products; 37 opportunities in the railroad field, and 191 opportunities in miscellaneous industries.

Among the electrical materials simplification of which was suggested in the answers to the A. S. M. E. questionnaire, are the following: Electrical attachment plugs, diaphragms on radio head sets, electrical fixtures and boxes, lighting fixtures, electrical wiring fittings, panelboards and switches, electric fuses, electrical motors, motor bases and frames, electrical sockets, electrical vacuum cleaners, transformer oil, washing machines and insulated electrical wires.

Other developments in this activity by the committee are expected in the near future.

Reduced Freight Rates Forgotten in Prosperity

THOSE Senators and Representatives who have been planning to make a drive at the next session of Congress for reduced freight rates are perturbed by the prospect that such agitation will not arouse any popular enthusiasm. When prices are good the average shipper is more interested in service than he is in the rate. On most electrical commodities the freight rate really represents a small percentage of the selling price.

When prices are hovering around the cost of production the freight charge looks big. For that reason the agitation of railroad legislation in 1921 and early in 1922 struck a popular chord. It appealed particularly to the demagogues of Congress. It is believed, however, that in prosperous times there will be no general support for any legislation which would instruct the Interstate Commerce Commission to regard an amount less than 6 per cent as a fair return or to take into account other factors which would have the effect of lowering rates.

Transportation specialists in Washington agree that more efficient service is being rendered by the railroads at this time than ever before has been the case. The proportion of unfilled car orders to the total loadings is very small. This has been made possible through closer co-operation and more friendly relationships with the shippers, through the reduction to the minimum of bad-order equipment, and through the placing in service of increasing numbers of new cars.

Chicago Business Continues at Normal Stride

CHICAGO business continues normal. Jobbers report steady demand for electrical merchandise, although no exceptional activity is noticeable. Price advances were announced this week on single-phase fractional-horsepower motors and high-tension equipment of a certain class, and the former policy with reference to jobbers purchasing wiring devices was revised.

Single-phase, 1,725-r.p.m. motors ranging from ¼ hp. to ½ hp. advanced 10 per cent. Motors rated at ¼- ⅓- ½-hp., 1,140 r.p.m., advanced 7½ per cent. High-tension equipment of one class advanced approximately 5 per cent.

One manufacturer of wiring devices adopted the policy of selling only in standard-package quantities of twenty cartons. While this may appear as a hardship to the jobber, he will really benefit by this system ultimately. It is expected that other manufacturers will follow suit.

The demand for storage batteries has apparently decreased during the first part of May. This is attributed mainly to the fact that many consumers have had taxes to meet at this time and have held off their individual purchases accordingly, while throughout the country districts the farmer has been busy in his fields. The summer season coming on also brings a slowing up of radio-battery purchases. The situation on flatirons remains the same, while there is the normal demand for fans for this season of the year.

Street Lighting Business Healthy in Various Parts of Country

SLOW but substantial growth of business with a steady interest in ornamental illumination characterizes present street-lighting equipment sales in various parts of the country. Although the close of the war opened the door for larger expenditures for street illumination, municipalities in many quarters have moved rather slowly in assigning marked increases in budgets for new development work in this field, and a good deal of skillful sales engineering has been necessary to spread the idea of improved service.

One manufacturing company found it helpful in showing representatives of municipal governments the latest progress in highway illumination to construct a working model built accurately to scale and equipped for varied demonstrations of unit spacing, variations in road surface, effect of miniature automobile headlight rays, etc., all arranged in a large darkened room and flexibly wired to facilitate quick and complete changes in apparatus.

Visits to the factory have been productive and a great deal of time has been saved in studying various layouts. So far as reported, there appears to be no difficulty of moment in making deliveries of either arc or incandescent street-lighting equipment. About this time of year municipal appropriations tend to keep manufacturing plants busier, and the general improvement of trade throughout the country is reflected in many additional orders, scattered to be sure, but effective in the rising volume of national sales.

March Electrical Exports Show $1,344,544 Increase

TOTAL exports of electrical machinery, apparatus and appurtenances for March were $6,344,842, a gain of $1,344,544 over March, 1922, when the total amounted to $5,000,298. In February, 1923, total electrical exports amounted to $4,839,738. The following figures are supplied by the Bureau of Foreign and Domestic Commerce:

ELECTRICAL EXPORTS FOR MARCH, 1923, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

Articles	Value March 1922	Value March 1923
Turbines	$23,759	$7,570
Generators:		
Direct-current—		
Under 500 kw.	36,835	67,830
500 kw. and over	52,607	92,049
Alternating-current—		
Under 2,000 kva.	23,081	10,960
2,000-kva. and over	143,866	131,022
Accessories and parts for generators	22,148	38,695
Self-contained lighting outfits	25,165	57,514
Batteries:		
Primary	111,620	123,388
Storage	117,147	176,669
Transforming and converting apparatus:		
Transformers—		
Power	298,379	362,707
Other	19,607	59,167
Rectifiers, condensers, double-current and motor generators, dynamotors, synchronous and other converters	47,486	250,844
Transmission and distribution apparatus:		
Switchboard panels, except telephone	65,125	138,588
Switches and circuit breakers above 10 amp.	150,212	166,180
Fuse and fuse blocks	11,187	21,551
Meters and measuring instruments:		
Watt-hour and other measuring instruments	51,954	49,022
Volt, watt and ampere meters and other recording indicating and testing apparatus	61,316	103,706
Lightning arresters, choke coils, reactors and other protective devices	20,628	42,254
Motors, starters and controllers:		
Motors under 1 hp.	71,171	128,276
Stationary motors 1 to 200 hp.	181,394	217,155
Stationary motors over 200 hp.	65,880	65,795
Railway motors	5,000	.....
Electric locomotives—		
Railway	.....	474,098
Mining and industrial	14,553	18,780
Other motors	19,738	13,183
Rheostats, controllers and other starting and controlling equipment	52,216	137,373
Accessories and parts for motors	112,242	112,470
Electric fans	112,302	159,184
Electric lamps:		
Incandescent—		
Carbon-filament	5,402	3,471
Metal-filament	164,721	117,489
Other electric lamps	13,858	19,027
Flashlights	22,602	43,284
Searchlights and projectors	12,403	14,641
Motor-driven household devices	49,877	72,294
Domestic heating and cooking devices	48,123	97,567
Industrial electric furnaces and ovens	25,536	13,719
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	47,480	64,680
Signal and communication devices:		
Radio and wireless apparatus	21,180	213,094
Telegraph apparatus	12,582	16,643
Magneto telephones	*	7,399
Other telephones	519,442	31,327
Magneto switchboards	*	2,964
Other telephones switchboards	*	34,718
Railway signals, switches and attachments	43,857	33,623
Bells, buzzers, annunciators and alarms	3,554	12,582
Other electrical apparatus and appurtenances:		
Spark plugs, magnetos and other ignition apparatus	94,413	111,978
Insulating material	80,139	129,986
Metal conduit, outlet and switch boxes	16,832	51,784
Sockets, receptacles and lighting switches	16,079	90,673
Other wiring supplies and fixtures	77,357	204,647
Other electrical apparatus not elsewhere specified	11,080,188	644,170
Globes and shades for lighting fixtures	29,787	39,561
Electrical glassware, except for lighting	16,043	24,301
Electrical porcelain	176,323	169,662
Electrical carbons, carbon brushes and electrodes	54,451	184,956
Insulated wire and cable (iron or steel)	27,692	83,103
Other manufactures of aluminum	86,096	66,062
Copper:		
Bare wire	208,661	111,033
Insulated wire and cable	129,002	408,374
Total electrical exports	$5,000,298	$6,344,842

*Not separately stated prior to Jan. 1, 1923.

New England Appliance Sales Show Marked Increases

SALES of socket appliances in New England reflect a remarkable increase in buying power on the part of the public compared with last year. The demand for washers and cleaners has reached a point where substantially full plant capacity must be utilized to meet the needs of the national market. One large manufacturing plant in this section is now working at night on production. Prices are holding firm on the better-grade products.

One representative distributor of socket devices said recently that his sales are double those of last year to date. Transportation embargoes are being gradually done away with, but rail shipments are still slow and unsatisfactory in this section, especially on freight handled through New England gateways. Retail buying of appliances is greatly stimulated by the growing use of national advertising, accompanied by intensive local sales campaigns.

English Electrical Exports £165,129 in March

THE following are official values of electrical machinery, apparatus and material exported from England (*a*) during March, 1923, and (*b*) the aggregate figures from Jan. 1 to March 31, with increase or decrease compared with corresponding periods in the year 1922.

The total exports of electrical machinery, material and apparatus, other than insulated wire, were £949,457 for March, which was a decrease of £165,129 from those exports during the month of February, 1922:

Electrical machinery (*a*) £296,524 (decrease £188,591), (*b*) £1,015,716 (decrease £420,678); including railway and tramway motors, (*a*) £21,663 (decrease £891), (*b*) £66,654 (increase £13,044); other generators and motors, (*a*) £140,922 (decrease £136,529), (*b*) £526,949 (decrease £272,241); and other electrical machinery, (*a*) £133,939 (decrease £51,171), (*b*) £422,113 (decrease £161,481); telegraph and telephone cables, submarine, (*a*) £47,281 (increase £29,508), (*b*) £149,676 (increase £69,425); other than submarine (*a*) £98,476 (increase £68,637), (*b*) £220,385 (increase £74,649); telegraph and telephone apparatus, (*a*) £116,557 (decrease £63,709), (*b*) £462,213 (decrease £78,856); other electrical wires and cables, rubber insulated (*a*) £82,964 (increase £34,437), (*b*) £296,526 (increase £150,953); with other insulations, (*a*) £92,610 (decrease £5,900), (*b*) £269,398 (decrease £68,069); carbons, (*a*) £7,183 (increase £3,681); (*b*) £17,342 (increase £4,734); glow lamps, (*a*) £20,795 (decrease £17,554), (*b*) £76,033 (decrease £20,909); arc lamps and searchlights, (*a*) £943 (decrease £810), (*b*) £1,689 (decrease £1,156); parts of arc lamps and searchlights (other than carbons) (*a*) £162 (decrease £449), (*b*) £246 (decrease £1,146); batteries, (*a*) £48,934 (increase £1,414), (*b*) £143,457 (increase £37,544); electrical instruments (commercial and scientific) and electricity meters, (*a*) £21,324 (decrease £12,423), (*b*) £78,317 (decrease £27,624); switchboards, (*a*) £3,934 (decrease £11,567), (*b*) £26,980 (decrease £98,885); other electrical goods and apparatus, (*a*) £111,770 (decrease £1,803), (*b*) £324,051 (decrease £12,798). Total of electrical machinery, material and apparatus other than insulated wire, (*a*) £949,457 (decrease £165,129), (*b*) £3,082,029 (decrease £394,808).

The Metal Market

Conditions are little different in the non-ferrous metal market from those that have existed during recent weeks. The international situation still dominates the market, and so long as London prices exhibit almost continuous declines from day to day buyers on this side are likely to hold off. The time must soon come, however, when supplies will be needed for nearby consumption, and there is then likely to be a scramble for early deliveries. Germany is not taking anywhere near her normal requirements of metal, and as she is the most important consumer in Europe, her withdrawal from the market has had a bad effect.

The Ruhr difficulty seems to be no less unsettled than last week, and there seems to be little hope of an immediate improvement. Without a stronger feeling in the London metal market, prices cannot advance here until buying in substantial volume appears. The bright spot is that consumption has not fallen away to any great extent and buyers must soon come into the market for at least small tonnages to meet current requirements.

NEW YORK METAL MARKET PRICES

	May 9, 1923 Cents per Pound	May 16, 1923 Cents per Pound
Copper, electrolytic	16.62½	15.75
Lead, Am. S. & R. price	8.00	7.75
Antimony	8.00 to 8.25	8.00
Nickel, ingot	28.00–30.00	28.00 to 30.00
Zinc, spot	7.37½	7.15
Tin, Straits	45.00	45.00
Aluminum, 98 to 99 per cent.	26.00	26.00

The last government report shows March exports of copper to have been 61,531,000 lb., exclusive of shipments to Canada. This figure includes finished as well as unwrought copper and makes the total for the first quarter approximately 185,000,000 lb. With April estimated at 80,000,000 lb., total for first four months is 265,000,000 lb.

Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Electric Storage Battery Reports Largest Year in Its History

The Electric Storage Battery Company, Philadelphia, reports the largest year in its history, according to Herbert Lloyd, president. Mr. Lloyd said the demand for automobile, radio and telephone accessories continues unabated and that a shortage of skilled labor would be the only factor that might serve to restrict production.

"Orders are coming in in considerable volume," he continued. "The Crescentville plant is operating at two-thirds capacity and the remainder will be equipped and ready in the near future. That part of the new plant that has been in operation for six months has demonstrated its efficiency. We are now employing four thousand men and women, more than ever before were on the payroll."

Link-Belt Moves Pittsburgh Office

Notice has recently been received of the removal of the Link-Belt Company's Pittsburgh branch office from its old quarters at 1501 Park Building to its new and more commodious offices at 335 Fifth Avenue. T. F. Webster, manager of the Pittsburgh office, says that larger space and the more convenient location were imperative because of the large volume of business transacted during the past year, which promises to remain in full swing at least for the coming fiscal year.

Pelton Water Wheel Order

The Western States Gas & Electric Company has awarded a contract for building a 72-in. butterfly valve to the Pelton Water Wheel Company. This valve will operate under a head of 65 ft. and will be installed at the head of the penstock at the power company's new Eldorado plant near Placerville, Cal. It will be designed for both direct and remote control and for electric motor and hand operation.

Westinghouse, Except Radio, Is Filled to Limit with Orders

The Westinghouse Electric & Manufacturing Company is working at full capacity in every department excepting the radio division. The production of small motors is nearly 300 per cent greater than a year ago.

A. B. Reynders, works manager at Springfield, predicts that radio is due for a revival. He says: "Production in our radio department has fallen off since January, chiefly because we have suspended operations to a certain extent while disposing of enormous accu-

mulated stock of apparatus completed last year.

"The demand has been so large that our surplus stocks have nearly been absorbed, and we shall resume production in this department at the normal rate soon. The outlook for industry in the electrical field is very favorable. If the radio demand continues, we expect to be more busy during the next four than during the past four months."

Square D Appointments

The Square D Company, safety-switch manufacturer, Detroit, announces the following recent additions to its sales force:

H. R. Thornburgh, formerly of the Western Electric Company, and W. F. Clarke of the M. W. Duncan Company, manufacturer of "Nokorode" paste, Providence, R. I., have been added to the New York branch organization. R. W. Coblentz has taken over the Northwest Pacific Coast territory and has established himself at Portland, Ore., under the direction of E. S. Conrad of the San Francisco branch. E. J. Burke will help handle the Philadelphia territory.

H. N. Foster, recently with the W. J. Fisher Company, manufacturers' agent, Detroit, has joined the Detroit sales force.

Rome Wire Offering New Issue of $3,000,000 Gold Notes

A new issue of $3,000,000 three-year 6 per cent sinking-fund gold notes, due May 1, 1926, is being offered by the Rome Wire Company, manufacturer of copper rods, wire and cables.

The Rome Wire Company, incorporated in New York in 1905, has its main plant at Rome, N. Y. Plants are situated on 45 acres of land and have 669,000 sq.ft. of floor space. Output in 1922 was more than 76,000,000 lb. of copper rods, copper wire and copper-wire products. Sales in 1922 were in excess of $10,000,000.

Total net assets, upon completion of the present financing, amount to $8,404,562, or 280 per cent of this $3,000,000 issue, constituting the company's total funded debt. These net assets include all securities of the Buffalo subsidiary, except $500,000 notes which the company has guaranteed. Fixed assets are carried on the books at $2,667,221, considerably less than value based upon outside appraisal in 1920 and additions since that time. Net current assets alone are $5,674,488.

E. C. Butler Now Associated with American Electric Equipment Firm

Edwin C. Butler has discontinued the electrical contracting business under the name of E. C. Butler Electric Corporation, 1402 Broadway, New York City. He is now associated with the engineering and sales division of the American Electric Equipment Company, subsidiaries of which are the Localized Lighting Corporation and the Home Lighting Equipment Corporation. This company makes a line of lighting fixtures for the factory, office and home, the operating principle of which is covered by the well-known patents of the Anderson adjustable arm, namely friction disks and interior disk wiring. The office is in the Longacre Building, 151 West Forty-second Street.

Copper Export Directors Chosen When Guggenheims Quit

Directors of the Copper Export Association were re-elected last week. Murry and Simon Guggenheim resigned as directors and Stephen Birch, president of the Kennecott Copper Corporation, and John K. MacGowan, vice-president of the Braden Copper Company, took their places to fill the remainder of their unexpired terms.

The retirement of the Guggenheims is said to have no significance other than that they felt it would be better to have two of their executives upon the board dealing with technical matters.

Riley Stoker Sales Abroad and at Home

The Sanford Riley Stoker Company, Worcester, Mass., has received a contract for four 1,600-hp. automatic stokers from the Nippon Power Company for installation in a plant in Tokyo, Japan. About ten cars will be required to transport the parts across the United States for Oriental shipment.

The company has recently shipped five carloads of stokers to Sydney, Australia, for the generating station of the municipal council. An order for four large stokers has been received from the Public Service Electric Company, Newark, N. J., and also four for the municipal generating plant at Lansing, Mich.

The Westland Engineering Supply Company, 760 Monadnock Block, Chicago, recently capitalized at $5,000, will manufacture and deal in power plant parts and appliances. Benjamin E. Seaman, Harry M. Everson and Lillian Everson are incorporators.

The Pittsburgh Transformer Company, Columbus and Preble Avenues, Pittsburgh, manufacturer of electrical equipment, has acquired property at Juniata and Metropolitan Streets for extensions. R. V. Bingay is president.

The United States Electrical Tool Company, Cincinnati, announces that it has established a branch at 430 North High Street, Columbus, Ohio, E. W. Beeler in charge, and another at 412 First National-Soo Line Building, Minneapolis, Thomas H. Caley in charge.

The Instant Electric Water Heater Company, Bridgeport, Conn., recently organized with capital stock of $250,000, will succeed to the business of the Bridgeport Manufacturing Company. A plant has been leased at Knowlton Street and East Washington Avenue. H. E. Dineson is president.

The Appliance Manufacturing Company, 10 Hoadley Place, Hartford, Conn., is a recent incorporation to make and deal in electrical appliances, etc. The firm will have a capital stock of $50,000, and the officers chosen the past week include F. E. Wolcott of Hartford, president and treasurer; J. S. Wolcott, vice-president, and G. H. Anthony, secretary. The concern has established a plant at the address mentioned above.

Harvey Hubbell, Inc., of Bridgeport, Conn., manufacturer of electrical switches, sockets, etc., has increased its capital stock from $300,000 to $2,000,000, consisting of 15,000 preferred and 5,000 common shares of stock, par value $100.

The Bryant Electric Co., Bridgeport, Conn., large manufacturers of electric switches, etc., recently increased its capital stock from $2,000,000 to $3,000,000, the increase consisting of 40,000 shares of common stock with a par value of $25. The firm completed several large building additions to its plant in the last two years, and the plant is very busy at the present time.

The Robertson-Cataract Company, Buffalo, N. Y., plans to open a distributing branch in Watertown, N. Y.

Stovel & Brinkerhoff, electrical engineers, 136 Liberty Street New York City, announce the addition of H. M. Van Gelder as a partner and a change of name to Stovel, Brinkerhoff & Van Gelder. Mr. Van Gelder, member A. I. E. E., has had an active experience of over twenty years in electrical engineering and construction.

C. Brandes, Inc., manufacturer of radio head sets, 237 Lafayette Street, New York City, has recently added another 5,000 sq.ft. of floor space and much new equipment to its assembly plant in order to increase production.

The Fay Mendenhall Electric Company, 44 West South Street, Indianapolis, Ind., is planning for an addition to its plant and the installation of equipment.

E. D. & A. F. Cronk, Inc., Hotel Street, Utica, N. Y., has plans for the construction of a two-story addition to its electric motor and equipment manufacturing plant. T. H. Williams, Devereaux Block, Utica, is architect.

The Crescent Truck Company, Lebanon, Pa., manufacturer of electric trucks and tractors, is building a one-story addition, 40 ft. x 100 ft., to its factory in order to enlarge production facilities.

The Ace Electric Cord Adjuster Company, Twenty-fifth Street and Park Avenue, New York City, is the name of a recent incorporation for $20,000 to manufacture electrical equipment. The incorporators are G. F. Brown, A. Helfat and W. H. Oakes.

Ross, Inc., 5414 Rainier Avenue, Seattle, Wash., recently organized to manufacture electric ovens and heating appliances, has obtained a factory and purchased equipment. A. R. Ross heads the company.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Turin, Italy (No. 6,362), for electrical novelties for household use.

An agency is desired in Vienna, Austria (No. 6,382), for air compressors of small dimensions which can be easily attached to the automobile or air compressors which are operated by electric motors from a battery in the car.

An agency is desired in Marseilles, France (No. 6,407), for light, strong, easily conducted electric or gasoline tractors, capable of being used in shipyards, railway stations, factories and on farms.

An agency is desired in Cairo, Egypt (No. 6,413), for railway engines, telephone equipment, Diesel and semi-Diesel engines, ice-making machines, etc.

An agency is desired in London, England (No. 6,430), for intercommunicating telephone equipment.

AUTOMATIC TELEPHONES PROPOSED FOR RIGA.—A new automatic telephone system to replace the present system in Riga, according to *Commerce Reports*, has been proposed by the General Director of the Latvian Post and Telegraph Bureau of the Ministry of Communication. The plans call for a machine-switching telephone exchange capable of caring for 10,000 lines, with a maximum of 20,000 lines. It is proposed to install the new system in the building erected for that purpose in 1914. The installation will be extended over a period of about four years. The cost is estimated at about $600,000.

DEMAND FOR ELECTRICAL GOODS INCREASING IN INDIA.—Owing to extensions of electric power facilities and the popularity of electric drive in Indian mills, *Commerce Reports* states, the demand for electrical goods is increasing in India.

PROPOSED ELECTRIC PLANT FOR PENANG.—Tenders are being called, *Commerce Reports* states, through the crown agents for an electric light plant for the city of Penang and the new Prai docks, Straits Settlements. The crown agents, it is reported, are also calling for bids for new telephone equipment for Penang.

DEMAND FOR POWER-PLANT EQUIPMENT IN NORWAY.—Power-plant equipment and supplies, according to *Commerce Reports*, are in good demand in the district around Bergen, Norway. In the districts of More, Sogn og Fjordene and Hordaland there are 664 power stations with a total capacity of 279,885 kw. A list of Bergen commission agents interested in electrical equipment may be obtained from the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, by referring to file No. 91,960.

New Apparatus and Publications

ELECTRIC LIGHTING FIXTURES.—The Louisville Composition Products Company, 840 East Jefferson Street, Louisville, Ky., has issued catalog "C," which describes and illustrates its various types of lighting fixtures.

POWER HACKSAW.—A power hacksaw designed for precision work when sawing materials has been placed on the market by E. C. Atkins & Company, Indianapolis, known as the "Kwik-Kut."

HEATING PAD.—The Edison Electric Appliance Company, Inc., 5660 West Taylor Street, Chicago, has brought out a new flexible cloth heating pad.

SWITCH PANEL.—A master switch panel has been placed on the market by the Palmer Electric & Manufacturing Company, 175 Fifth Street, Cambridge, Mass.

MINING MACHINE.—An improved model of the "Arcwell" mining machine, used particularly for low seams of coal, has been brought out by the Jeffrey Manufacturing Company, Columbus, Ohio.

BATTERY TERMINAL PULLER.—A battery terminal puller which can be used without pliers, screwdrivers or other tools has been brought out by the Bird Manufacturing Company, Marshalltown, Iowa.

ELECTRIC HOISTS.—The Link-Belt Company, 910 South Michigan Avenue, Chicago, has issued a book on "Electric Hoists and Overhead Cranes" which contains illustrations showing some of the most recent "Link-Belt" electric hoist applications, with line and wash drawings. The publication is known as "Book No. 480."

BLUEPRINTING MACHINE.—Wickes Brothers, Saginaw, Mich., have placed on the market a blueprinting machine for printing continuous rolls or separately cut sheets.

ELECTRIC RANGE.—An electric range with two electric units in an insulated oven has been brought out by the Magee Furnace Company, 38 Union Street, Boston.

ELECTRIC WASHING MACHINE.—The Station-Airy Company, Pitt Building, Cleveland, has brought out an electric washing machine, known as "Station-Airy."

FLOOD LIGHT.—The Pyle National Company, 1334 North Kostner Avenue, Chicago, has developed a new flood light, known as the "Pyle-O-Light."

New Incorporations

THE MONTAUP ELECTRIC COMPANY, Fall River, Mass., has been incorporated with a capital stock of $7,500,000 to generate, transmit and sell electricity to the Blackstone Valley Gas & Electric Company, the Fall River Electric Company and the Edison Electric Illuminating Company of Brockton. The officers are: Simeon B. Chase, president; Henry B. Sawyer, treasurer; Roy F. Whitney, A. Stuart Pratt and Victor D. Vickery, directors.

THE KELSO-WURDACK COMPANY, 2169 Railway Exchange Building, St. Louis, has been organized to manage, own and operate utility plants and other companies. The company will take over the control of the companies previously operated by the Light & Development Company of St. Louis. It is also prepared to render engineering, managerial, financial and other services usually furnished to utility properties. The officers are: Hugo Wurdack, president; J. A. Porter, vice-president; I. R. Kelso, secretary; E. Strauss, treasurer, and E. S. Billings, chief engineer.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

DANBURY, N. H.—The Ford Motor Company, Highland Park, Mich., contemplates the installation of a power plant at its proposed local garnet powder works, to be used in connection with manufacture of glass, to cost about $150,000.

DORCHESTER, MASS.—The Boston Insulated Wire & Cable Company, 65 Bay Street, has filed plans for an addition, 40 x 40 ft., to its power house.

HOLYOKE, MASS.—Rights-of-way have been secured by the Turners Falls (Mass.) Power & Electric Company for a transmission line to Holyoke and also a site on the North Chicopee bank for a substation.

PLYMOUTH, MASS.—The Plymouth Electric Light Company has awarded contract to the Fred Ley Company, Boston, for the erection of 10 miles of high-tension transmission line, to cost about $35,000.

PAWTUCKET, R. I.—Extensive improvements are contemplated by the Blackstone Valley Gas & Electric Company to its systems in Woonsocket and Pawtucket, involving an expenditure of about $2,500,000. The plans for 1923 include the erection of additional tie lines to provide additional supply of energy to the Woonsocket division, the completion of the line between Woonsocket and Pawtucket, which will enable it to obtain power from either the Rhode Island Power Transmission Company or its own power station, the erection of an outdoor substation at Riverside and the complete rehabilitation of the distribution in Woonsocket. The work will be in charge of the Stone & Webster Engineering Corporation, Inc., Boston.

SOUTH NORWALK, CONN.—Contract has been awarded by the Crofut & Knapp Company for the construction of a power house, 50 ft. x 100 ft., in connection with its new hat factory. The cost of the entire plant is estimated at about $1,000,000.

Middle Atlantic States

BUFFALO, N. Y.—The Buffalo General Electric Company will erect a one-story building, 103 x 180 ft., near its power plant on Niagara Street, for general operating service.

NEW YORK, N. Y.—Bids will be received by S. B. Wight, agent, Room 338, 466 Lexington Avenue, New York City, until May 25 for incandescent lamp bulbs required by following companies for one year, to be covered by serial contract No. 16-1923: New York Central Railroad Company, Boston & Albany Railroad, Grand Central Terminal, Troy Union Railroad, New York & Harlem Railroad, New York State Railways, Rochester (N. Y.) Gas & Electric Corporation, Cleveland, Cincinnati, Chicago & St. Louis Railway, Indiana Harbor Belt Railroad Company, Union Passenger Depot Association, Cleveland; Schenectady (N. Y.) Railway Company, Rutland Railroad Company, Michigan Central Railroad Company, Pittsburgh & Lake Erie Railroad Company, Monongahela Railway, Trunk Line Association, Cincinnati Northern Railroad, Peoria & Eastern Railway Company, Chicago River & Indiana Railroad Company.

OGDENSBURG, N. Y.—The Ogdensburg Power & Light Company plans to erect a building for general operations at Caroline and Ford Streets, to cost about $150,000.

WATERTOWN, N. Y.—Bids will be received by Walter Ackerman, city manager, until May 25 for all work in connection with the construction of a hydro-electric plant in the city of Watertown. Paul B. Sutton is city engineer.

ELIZABETH, N. J.—Plans for the proposed plant to be erected on West Grand Avenue by the American Type Founders' Company, Communipaw Avenue, Jersey City, for the manufacture of printing presses, include a power station. The cost of the works is estimated at $500,000.

NEW LISBON, N. J.—Bids, it is understood, will soon be asked by the Department of Charities and Correction, Trenton, for the construction of a power house and ice-manufacturing plant at the Colony for Feeble-Minded, New Lisbon, to cost about $35,000. A. B. Mills, State Office Building, Trenton, is engineer.

CARLISLE, PA.—The West Pennsboro-Carlisle Electric Company, recently organized, plans to erect a transmission line and system for commercial service in this district. George M. Hays is interested in the company.

CONNEAUTVILLE, PA.—The Council has secured permission to acquire the local system of the United Electric Company, to be operated by the municipality. Extensions and improvements will be made.

EBENSBURG, PA.—Plans for the new hospital to be established at Ebensburg by the Commissioners of Cambria County and the Johnstown Society for the Prevention of Tuberculosis, both of Johnstown, to cost about $300,000, include a power plant. W. R. Myton, Johnstown, is architect.

LANCASTER, PA.—The United Gas & Electric Company, 61 Broadway, New York City, has acquired a number of electric companies in this section and will merge the systems, to be operated in conjunction with the Harrisburg (Pa. Light & Power Company. The transmission lines will be extended and additional equipment installed.

LYKENS, PA.—The American Briquette Company plans to rebuild its power plant, recently damaged by fire, causing a loss of about $200,000.

SLATINGTON, PA.—The American Slate Company contemplates rebuilding its power plant, recently damaged by fire, causing a loss of about $100,000.

TUNKHANNOCK, PA.—The Sullivan County Electric Company has acquired the property of the Tunkhannock Electric Company and will merge the systems. Extensions and improvements will be made; a transmission line is planned.

WARREN, PA.—Electric power equipment will be installed by the Conewango Refining Company, in connection with the rebuilding of its oil refinery, recently damaged by fire, causing a loss of about $600,000.

HAVRE DE GRACE, MD.—The Tiger Tire Company, Toronto, Ontario, Canada, will build a power plant in connection with a proposed local plant, to cost about $200,000.

BRISTOL, VA.—The Bristol Gas & Electric Company plans extensions and improvements to its system, to cost about $50,000.

HERNDON, VA.—Bids will be received by the Fairfax & Loudoun Light and Power Company until May 22 for erecting 13½ miles of 22,000-volt, three-phase wood-pole line, the material for same to be furnished by the company.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, until June 4, for electrical equipment for towing locomotives. (Circular 1529.)

WASHINGTON, D. C.—Bids will be received by the Chief of Engineers, United States Army, until June 15, for two Diesel engine-generating sets, with auxiliary apparatus, 150 kw. and 300 kw. capacity; also for miscellaneous spare parts for engines and generators.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until May 26, for switchboard supplies, including line jacks, relay assemblies, lamps, etc. (Circular PR-14773- 1CP); until May 28, for ten telephone battery charging rectifiers (Circular PR-14123-14CP); until May 25, for 120 dynamotors (Circular PR-14600- 6CP); until May 26, for thirty-six terminal boxes (Circular 14732- 1CP).

North Central States

DETROIT, MICH. — The Detroit Steel Corporation will build a power house at its proposed plant in the Oakwood section to cost about $250,000.

DETROIT, MICH. — The Ford Motor Company has awarded a contract to Stone & Webster, Inc., 147 Milk Street, Boston, for the construction of a 10,000-hp. hydro-electric plant on the Menominee River, near Iron Mountain. Stone & Webster, Inc., is now starting work on a large combined hydro-electric and steam power plant at the High Dam at St. Paul. Plans are also being prepared for a large manufacturing plant for the Ford Motor Company adjacent to the High Dam by Stone & Webster, Inc.

IRON MOUNTAIN, MICH.—The Michigan Iron, Land & Lumber Company is having plans prepared for a hydro-electric power plant, to cost about $1,000,000. Mead & Seastone, Journal Building, Madison, Wis., are engineers.

ZILWAUKEE, MICH.—The Consumers' Power Company, Jackson, has authorized plans for a 54,000-hp. steam-driven generating plant to cost about $3,000,000. Plans previously prepared for a power plant of about one-half this size will be abandoned.

CLEVELAND, OHIO—Separate bids will be received at the office of the commissioner of purchase and supplies, City Hall, Cleveland, until May 25 for lead-covered cable, steam boilers and superheaters, and for weatherproof copper wire for the division of light and power.

COLUMBUS, OHIO.—The City Council is considering an ordinance providing for an issue of $235,000 in bonds for the purchase of new equipment for the municipal electric light plant, including a 7,500-kw. generating unit and condenser, etc. The installation of a new street-lighting system in the business district is also under consideration by the Council.

LIMA, OHIO.—Arrangements are being made by the Ohio Power Company to increase its service in Lima. A substation will be built in the southern part of the city (the factory district), and transmission lines will be erected to tie the Lima plants with power units in Toledo, Cleveland, Youngstown, Fort Wayne, St. Mary's and Delphos.

UPPER SANDUSKY, OHIO.—The City Council has passed an ordinance authorizing an issue of $80,000 in bonds for the erection of an electric distributing system in Upper Sandusky. Electricity will be purchased from the Ohio Power Company.

LOUISVILLE, KY.—Plans are being prepared by H. M. Byllesby & Company, 208 South La Salle Street, Chicago, for extensions to the steam-power plant of the Louisville Gas & Electric Company on the River Road, to cost about $150,000.

PADUCAH, KY.—The Paducah Electric Company will enlarge its power house and install additional equipment, including a 2,500-kw. turbo-generator, boilers, coal and ash-handling machinery and auxiliary equipment, to cost about $300,000.

FORT WAYNE, IND.—The Board of County Commissioners will build a power house in connection with the proposed court house building, to cost about $500,000.

LAFAYETTE, IND.—The construction of a new heating and power plant this summer for the Purdue University has been approved by the board of trustees. The cost is estimated at $300,000.

ATHENS, ILL.—The Public Service Commission has granted the Central Illinois Public Service Company permission to purchase the local electric plant. The transmission line from Athens to Petersburg will be rebuilt.

LUCK, WIS.—The Luck Light & Power Company has applied to the Railroad Commission for authority to issue $5,000 in capital stock for extensions and improvements to its plant.

MILWAUKEE, WIS.—Contract has been awarded by the Milwaukee Electric Railway & Light Company for the construction of a turbine and boiler house at Lakeside, to cost about $1,000,000.

WAUKESHA, WIS.—The Board of Public Works is receiving bids for extending the ornamental lighting system on Broadway, Madison, Grand, Main, Clinton and South Streets, to cost about $25,000. A. P. Kuranz is city engineer.

MINNEAPOLIS, MINN.—Plans are being prepared by the Minneapolis General Electric Company for the construction of a terminal station at First and Aldrich Avenues, to cost about $75,000.

CHEROKEE, IOWA. — The Cherokee Electric Company contemplates erecting an addition to its power station and installing new equipment. Contract, it is understood, has been placed for a 250-hp. engine.

DUNBAR, IOWA.—The Dunbar Light & Power Company, recently organized, plans to supply electricity in Dunbar and vicinity. John Ingebritson is president.

SHENANDOAH, IOWA.—Bids will soon be called for an ornamental lighting system in the business section. The Henningson Engineering Company, Twelfth and Harney Streets, Omaha, Neb., is consulting engineer.

WATERLOO, IOWA. — Electric power equipment will be installed at the five-story ice manufacturing and cold-storage plant, 90 ft. x 100 ft., to be built by the Rath Packing Company, Elm and Sycamore Streets, to cost about $150,000.

KANSAS CITY, MO.—The Kansas City Power & Light Company plans to build an addition to its building at Twenty-fifth Street and Pennsylvania Avenue for general operating and mechanical service.

LUDLOW, MO.—The citizens have authorized the installation of an electric lighting system. The service will be supplied by the Northwest Missouri Power & Light Company, Excelsior Springs.

MOBERLY, MO.—Electric power equipment will be installed in the local ice-manufacturing and cold storage plant to be erected by the Polar Wave Ice & Fuel Company, 3626 Olive Street, St. Louis, to cost about $250,000.

POTOSI, MO.—Steps have been taken by the Chamber of Commerce to establish an electric plant in Potosi.

ST. LOUIS, MO.—The Missouri Pacific Railroad Company plans to build a power house in connection with its proposed local grain elevator, to cost about $1,000,000.

ST. LOUIS, MO.—Electric power equipment will be installed in the ice-manufacturing and refrigerating plant to be erected by the St. Louis Dairy Company at Twentieth and Pine Streets, estimated to cost $100,000.

FARGO, N. D.—The Union Light, Heat & Power Company contemplates installing an additional generating unit, condenser type, to double the output of its plant. The cost is estimated at about $300,000.

BERESFORD, S. D.—Investigations are being made with a view of extending the service of the municipal electric light plant to Alsens and also to furnish electricity to residences along the line.

PIERRE, S. D.—Bids will soon be called for the installation of an electric distributing system. The Charles L. Pillsbury Company, 1200 Second Avenue, South, Minneapolis, is engineer.

ADAMS, NEB.—Improvements to the municipal electric light plant, to cost about $6,000, are under consideration.

AINSWORTH, NEB.—The electric plant of the Ainsworth Light & Power Company was recently damaged by fire, causing a loss of about $20,000.

SILVER CREEK, NEB.—Plans are under consideration to rebuild the distribution system of the municipal electric plant.

SEVERY, KAN.—The City Council is negotiating with the officials of the Eastern Kansas Electric Company to erect a high-tension transmission line to Severy to supply electricity to operate the local system. The company offers to erect the line to the municipal plant and erect a substation. The city is to pay $12,500 toward the construction of the line.

Southern States

CONCORD, N. C.—The Concord Knitting Company will build an electric power plant in connection with a proposed cotton mill.

LEXINGTON, N. C.—C. M. Wall & Son plan to rebuild their power house and woodworking mill, recently destroyed by fire.

RIDGEWAY, S. C.—Bonds to the amount of $58,000 have been sold, part of the proceeds to be used for an electric lighting system.

COLUMBUS, GA. — Extensive improvements, to cost about $100,000, are under consideration by the Columbus Electric & Power Company. The work will include the erection of a substation on Second Avenue and the installation of three large transformers at the Goat Rock station. Connection has been made with the system of the Georgia Railway & Power Company, which has increased the voltage from 66,000 to 110,000.

ST. PETERSBURG, FLA.—The St. Petersburg Power & Lighting Company is reported to have purchased a site in Pasedena on which it will erect a substation.

BRICEVILLE, TENN. — The Cambria Coal Mining Company, Knoxville, plans to rebuild the power plant at its local properties, recently destroyed by fire.

CLINTON, TENN.—The Knoxville Power & Light Company has petitioned the Federal Power Commission for permission to build a large hydro-electric development on the Clinch River in Scott and Lee Counties, Virginia. The plans call for the construction of four dams on the Clinch River in Tennessee and Virginia.

LAFOLLETTE, TENN.—The Lafollette Water, Light & Telephone Company contemplates extensions and improvements to its hydro-electric plant.

SPRINGFIELD, TENN. — Preparations are being made to enlarge the municipal electric light and water plant. New equipment including a turbine will be installed.

ALBANY, ALA.—Plans are being considered by the Alabama Water Company for the installation of electrically operated pumping machinery, to cost with other extensions about $100,000.

BIRMINGHAM, ALA. — The Alabama Power Company has petitioned the Public Service Commission for permission to extend its electric transmission lines to Waverly, Wetumpka, Centerville and Union Springs.

RUSSELLVILLE, ALA. — Plans have been authorized for a municipal electric light and power plant, to cost about $40,000.

BLYTHEVILLE, ARK.—The Waggoner-Gage Corporation plans to install a power plant in connection with a proposed cotton-oil mill, to cost about $250,000.

LITTLE ROCK, ARK.—The installation of an improved lighting system on Main Street is under consideration by the Merchants' Bureau of the Board of Commerce.

NEW ORLEANS, LA.—The installation of an ornamental lighting system on Magazine Street is under consideration by the Business Men's Associations.

CHICHASHA, OKLA. — The Chichasha Gas & Electric Company plans to erect a high-tension transmission line from Chichasha to Minnekah and Rush Springs.

SAPULPA, OKLA.—Negotiations are under way between the Oklahoma Union Railway Company and the Southwestern Railway Company for the construction of an electric railway from Sapulpa through Keifer to Nuyaka, connecting with the line of the Southwestern out of Bristow, with later extension to Okmulgee and Okemah.

ABILENE, TEX.—Under the terms of a contract between the city of Abilene and the West Texas Utilities Company, an entire new street-lighting system will be installed, including ornamental lamps in the business district and also along the full length of seven residential streets. The cost is estimated at $75,000.

CLEBURNE, TEX.—The installation of an ornamental lighting system is under consideration by the Council.

DALLAS, TEX.—The Dallas Textile Mills Company plans to build a power house in connection with a new cotton mill to be erected in the Love Field industrial district, to cost about $1,000,000. Robert & Company, Atlanta, Ga., are engineers.

DECATUR, TEX.—The Decatur Light & Water Company has installed a 250-hp.

gas-engine-driven generating unit and contemplates extending its high-tension transmission line to the towns of Boyd and Paradise. C. P. Dodson is manager.

FORT WORTH, TEX.—The Transcontinental Oil Company contemplates the installation of electric power equipment in connection with an addition to its local oil refining plant, to cost about $500,000.

TIOGA, TEX.—C. P. Dodson, Decatur, who has recently acquired the local electric plant, plans to rebuild the distribution system and to erect a three-phase transmission line to the Pilot Point plant, which will supply electricity for the system in Tioga.

WACO, TEX.—The Missouri, Kansas & Texas Railway Company has prepared plans for the electrification of its Bellmead car and locomotive shops.

Pacific and Mountain States

CONCRETE, WASH.—The Superior Portland Cement Company, Seattle, has applied for permission to build a hydro-electric power plant for service at its mills, to cost about $175,000.

MILLWOOD, WASH.—The Inland Empire Paper Company, Spokane, has acquired a power site on the Spokane River for a hydro-electric power plant.

TACOMA, WASH.—The City Council has authorized the installation of an ornamental lighting system on North J Street.

MERCED, CAL.—The Yosemite Cement Company, care of the Hunt Engineering Company, Kansas City, Mo., plans to build a power house in connection with its proposed cement manufacturing plant on the Merced River, to cost about $1,000,000.

MODESTO, CAL.—Bids will be asked at once by the Modesto Irrigation District for the construction of a transmission line to the boundary line of the Turlock Irrigation District. A new substation will be erected at Modesto. R. J. O'Connell is electrical engineer.

ROSEVILLE, CAL.—Work will soon begin on the erection of an ice-manufacturing plant and precooling plant at Roseville by the Pacific Fruit Express Company. The cost of the machinery is estimated at $200,000.

SAN BERNARDINO, CAL.—The Cajon Lime Products Company, recently organized, contemplates the construction of a power house at its proposed lime works near Camp Cajon, to cost about $200,000. W. F. Warner, Riverside, heads the company.

SAN FRANCISCO, CAL.—Plans for the proposed new plant of the Continental Furniture Manufacturing Company, to be erected at Slauson Avenue and Fifty-ninth Street, include a power plant. S. Heiman, 57 Post Street, is architect.

SAN FRANCISCO, CAL.—The California Railroad Commission has approved the contract of the Pacific Gas & Electric Company with the Truckee River General Electric Company, Reno, for the erection by the former of an electric transmission line to the summit of the Sierras, where it will connect with the line of the Truckee company now under construction.

SOUTH PASADENA, CAL.—Steps have been taken for the installation of an ornamental lighting system on portions of Camden and Court Avenues and Huntington Drive.

PAROWAN, UTAH. — Bonds to the amount of $72,000 have been sold, the proceeds of $65,000 to be used for the installation of a new municipal electric light plant.

DILLON, MONT.—The Union Electric Company is erecting a transmission line from Sheridan to Dillon and to erect a substation on Kentucky Avenue, just outside of the city limits.

Canada

BRANTFORD, ONT. — Extensions and improvements to the street-railway system, to cost about $40,000, are under consideration by the City Council.

BROCKVILLE, ONT.—The Hydro-Electric Power Commission of Ontario is negotiating for the purchase of the Ragged Chute water power on the Mississippi River above High Falls, where electricity is now generated for the Rideau system.

WALKERVILLE, ONT.—The City Council has approved a by-law authorizing an issue of $50,000 in debentures for extensions in the Hydro-Electric system this year.

WALLACEBURG, ONT. — The Hydro-Electric Power Commission of Ontario contemplates the erection of a transmission line from the local substation to Sombra, via Whitebread and Port Lambton, a distance of 16 miles.

Electrical Patents

Announced by U. S. Patent Office

(Issued April 24, 1923)

1,452,960. Wireless Transmitter; W. T. Ditcham, Twickenham, England,. App. filed Dec. 18, 1920. Inductively coupled type.

1,452,972. Signal System and Transmitter Therefor; R. M. Hopkins, Rutherford, N. J. App. filed Aug. 12, 1918. Fire-signal-transmitting mechanism employed with water-sprinkling system.

1,452,989. Heating Element; N. F. Strauss, Milwaukee, Wis. App. filed April 26, 1921. Liquid acts as conductor between electrodes.

1,453,017. Wall Bridge for Switches; G. H. Lindelof, De Kalb, Ill. App. filed March 22, 1922. Building wall for supporting switches, outlet boxes, etc.

1,453,025. Apparatus for Electric Arc Welding; R. S. Smith, Milwaukee, Wis. App. filed Dec. 6, 1918. Welding of sheet material.

1,453,026. Apparatus for Arc Welding; R. S. Smith, Milwaukee, Wis. App. filed Dec. 6, 1918. Welding of sheet material.

1,453,030. Means for Establishing a Voltaic Arc Between Electrodes not in Contact; F. C. Ucar, Madrid, Spain. App. filed July 6, 1915.

1,453,073. Safety Mechanism for Elevator-Shaft Doors; G. G. Laureyns, Newark, N. J. App. filed Dec. 3, 1919. Lock on door magnetically operated by elevator as it comes to floor level.

1,453,083. Electric Machine; M. Schuler, Neumuhlen, near Kiel, Germany. App. filed Oct. 25, 1916. Hydrogen gas used to ventilate that placed in inclosed-tank machine.

1,453,097. Multiple-Unit Induction Furnace; C. B. Foley, Bristol, Conn. App. filed Dec. 28, 1916. Induced secondary formed by metal within crucible.

1,453,132. Process for the Recovery of Pure Alkalies from Impure Lyes; K. Heinemann, Heidenau, Germany. App. filed Nov. 8, 1920. By electrolysis.

1,453,159. Cooling of Dynamo-Electric Machines; P. A. H. Mossay and H. C. E. Jacoby, London, England. App. filed Jan. 16, 1919. Cooling system for totally inclosed motors.

1,453,166. Rotary Electric Machine; K. Nobuhara, Muko-Gun, Hyogo-Ken, Japan. App. filed Oct. 23, 1919. Machine filled with liquid, air being used to force liquid from gap.

1,453,173. Electric Wire Clamp; P. Pairard, Paris, France. App. filed June 13, 1918. For fastening wires to pin insulators.

1,453,194. Dental-Film Holder; A. E. Shaw, Columbia, S. C. App. filed April 26, 1922. For X-ray machines.

1,453,195. Signaling Mechanism; J. C. Sims, Maynard, Mass. App. filed Nov. 6, 1919. Electrically operated visual and sounding signal.

1,453,201. Strain Insulator; L. Steinberger, Brooklyn, N. Y. App. filed Nov. 30, 1918. Exposed bridge portions insulated from leg portions.

(Issued May 1, 1923)

15,594 (reissue). Signal for Vehicles; T. B. Powers, Brooklyn, N. Y. App. filed Aug. 11, 1919. Rear direction signal.

1,453,267. Electron Emitting Cathode and Method of Making the Same; J. L. Bradford, New York, N. Y. App. filed Nov. 29, 1918. For electron tubes.

1,453,314. Current Regulator for X-Ray Systems; C. Fayer, New York, N. Y. App. filed April 2, 1918. Employed with Coolidge tubes.

1,453,316. Acoustic Method and Apparatus; R. A. Fessenden. Brookline, Mass. App. filed April 28, 1919. Submarine signaling.

1,453,321. Call-Distributing System; W. S. Paca, Oil City, Pa. App. filed Sept. 4, 1919. Applied to the operation of manual telephone exchange.

1,453,328. System of Ventilation; J. Smillie, Stretford, Manchester, England. App. filed Nov. 12, 1920. Closed-circuit system of generators.

1,453,333. System of Ventilation; K. Baumann, Urmston, England. App. filed Oct. 9, 1920. Closed-circuit system for generators.

1,453,343. Welded Joint; J. W. Fay, Milwaukee, Wis. App. filed Dec. 19, 1921. Method of making reinforced joint between two plates.

1,453,347. Electric Furnace; A. W. Gregg Chicago, Ill. App. filed July 11, 1921. For melting small quantities of material by electric arc.

1,453,349. Lighting Fixture; E. F. Guth, St. Louis, Mo. App. filed May 29, 1920. Indirect fixture for high-powered lamps.

1,453,357. System of Ventilation; J. E. Jolly, Stretford, Manchester, England. App. filed Oct. 6, 1920. Closed-circuit system for generators.

1,453,358. Process of Joining Metals; C. F. Kettering, Dayton, Ohio. App. filed Dec. 15, 1920. Attachment of non-ferrous metal-cooling elements (such as copper fins) to cylinders of internal-combustion engines.

1,453,359. Telegraph Sounder; J. H. Kinsley, Clinton, Mass. App. filed March 27, 1920.

1,453,368 and 1,453,369. Speed Regulator for Automobiles; F. W. Teves, East Elmhurst, N. Y. App. filed Jan. 25, 1922. Automobile cannot exceed predetermined speed limit.

1,453,387. System for Communicating with Moving Vehicles; L. Espenschied, Hollis, and H. A. Affel, Brooklyn, N. Y. App. filed Sept. 30, 1919. High-frequency current line from which signals are taken parallels tracks.

1,453,388. Electrolytic Condenser; C. Le G. Fortescue, Pittsburgh, Pa. App. filed Nov. 3, 1919. Insure maximum area of heat radiation.

1,453,389. Arc-Welding Dynamo Electric Machine; K. L. Hansen, Wilkinsburg, Pa. App. filed Sept. 25, 1919. Constant-current generator employed in direct-current welding systems.

1,453,391. Alternating-Current Commutator Generator; R. E. Hellmund, Swissvale, Pa. App. filed Aug. 10, 1918. Stabilizing commutator motor for regeneration.

1,453,397. Protection of Resistors of Electric Furnaces; G. M. Little, Pittsburgh, Pa. App. filed April 21, 1921. Sooty oil flame deposits protection coating on resistors.

1,453,398. Self-Tightening Water-Cooled Terminal; G. M. Little, Pittsburgh, Pa. App. filed April 21, 1921. For electric resistance furnaces.

1,453,399. Means for Protecting Resistors in Electric Furnaces; G. M. Little, Pittsburgh, Pa. App. filed April 25, 1921. Oil forced into furnace deposits sooty coating on resistors and furnace walls.

1,453,410. Dynamo-Electric Machine; J. Slepian, Wilkinsburg, Pa. App. filed Dec. 17, 1919. Elimination of transformer and rotational electromotive forces of armature coils undergoing commutation.

1,453,412. System of Control; G. F. Smith, Wilkinsburg, Pa. App. filed Sept. 25, 1919. Regenerative braking of electric railway motors.

1,453,419. Electroplating Apparatus; W. Thompson and W. R. Jameson, Niagara Falls, N. Y. App. filed Sept. 12, 1921. For manufacture of knives, forks, spoons, etc.

1,453,430. Voice-Operated Relay; O. B. Blackwell, Garden City, N. Y. App. filed Nov. 22, 1919. Two-way repeater communication system.

1,453,435. Method and Apparatus for Nitrogen Fixation; C. H. Buettner, Cincinnati, Ohio. App. filed Nov. 17, 1921. Calcium or potassium nitrate made at place where they are to be applied to soil.

1,453,441. Excess-Demand Meter; G. A. Cheetham, Manchester, England. App. filed Oct. 6, 1920. Method of releasing indicating lever periodically.

1,453,442. Marking Machine; W. E. Choate, Westerly, R. I. App. filed April 26, 1921. Machine adapted to make impressions from electrically heated typed members or dies.

1,453,443. Lighting Fixture; W. E. Cochran, Cleveland, Ohio. App. filed June 1, 1920. Indirect lighting type.

1,453,453. Notifying or Call Device for Telephones; G. Forster, Philadelphia, Pa. App. July 24, 1920.

1,453,473. X-Ray Plate Changer; R. J. McKenna, Denver, Col. App. filed Feb. 23, 1922. Tunnel type.

1,453,491. Voltage-Regulating System; F. J. Champlin, Pittsfield, Mass. App. filed March 22, 1921. Induction regulator.

1,453,492. Overload Circuit Controller; C. B. Connely, Scotia, N. Y. App. filed Aug. 2, 1921. Overload relay.

1,453,498. Maximum-Demand Meter; W. L. Hamilton, Holyoke, Mass. App. filed Aug. 25, 1919. Curve-drawing type.

1,453,522. Control of Dynamo-Electric Machines; H. W. Rogers, Schenectady, N. Y. App. filed Oct. 6, 1922. Control of Ward Leonard motor-generator sets.

1,453,524. Wire Splicer; F. A. Ropp, Smithton, Pa. App. filed June 16, 1922. Clamping device for connecting ends of trolley wires.